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THE AUTOMOBILE

Porter-Knight Speed Creations

High-Speed, Sleeve-Valve Motors, Alloy Steels, Light Weight and Simplified Construction Features

Front view of Porter-Knight speed creation. Note minimized wind resistance

NEW YORK CITY, May 1—The Porter-Knight racing cars which THE AUTOMOBILE announced last January were to be built by Finley R. Porter, long famed in racing circles through his previous connections with Mercer cars, are now practically completed and the first of the three that are entered for the Indianapolis 500-mile race has been given its first tryouts over the roads around Port Jefferson, L. I., where Mr. Porter has been manufacturing them. This week speeds of 100 miles per hour and higher have been shown with the motor but partially worked in.

First American Racing Knights

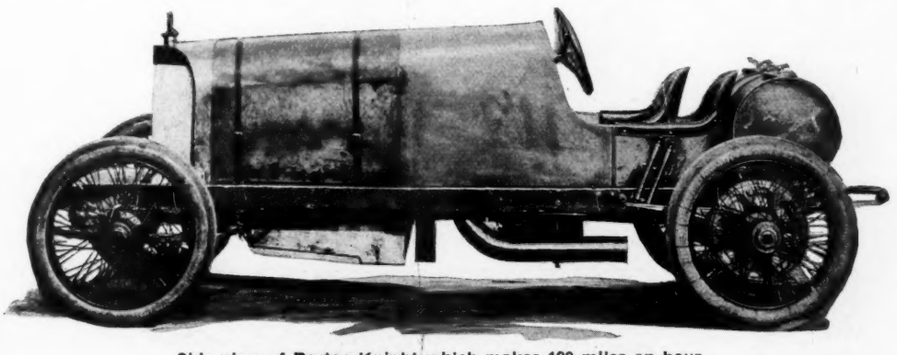
These Porter-Knight cars will be watched with more than usual interest during the coming racing season as they represent the first effort of an American manufacturer to develop a racing car using the Knight double-sleeve action in place of the conventional poppet valves. Although this is the first American effort, it is not the first time this type of motor has been used in speed contests. Two years ago a Mercedes-Knight competed at Indianapolis and its performance was one of the features of the meet, the car being a standard Mercedes model with a piston displacement too small to be considered a serious contender.

Last year in the Isle of Man road races in the British Isles a team of Minerva-Knights, built by the Minerva company in Belgium, proved the sensation of the meet, the team making the best performance of any.

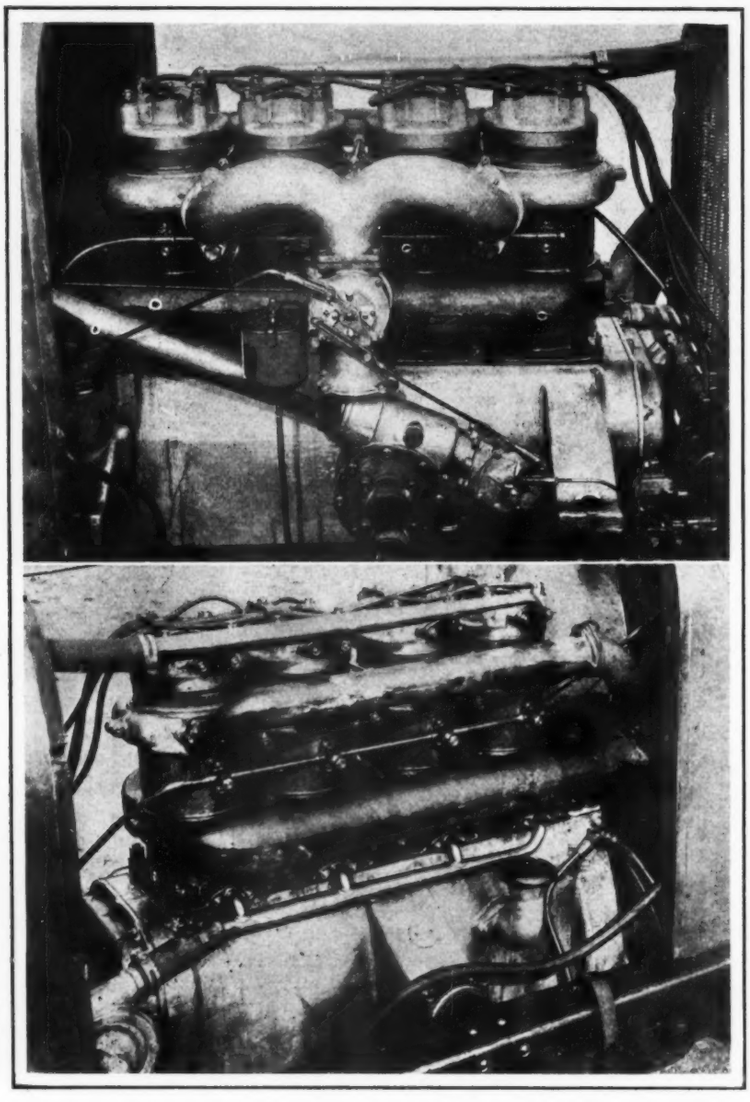
Although the time allotted Mr. Porter for developing the present Porter-Knight models has been only since February 1, he has succeeded in incorporating into these machines details heretofore not used in Knight-motored vehicles; he has endeavored to put into them much of the valuable experience gained in poppet-valve racing; and because of this America will have its first opportunity of observing the American sleeve-valve motor perform in a field which it has not heretofore invaded.

Design of Three Cars Identical

The three Porter-Knight racing cars are identical in every respect. Compared with the stock Knight motor used by American makers producing this type, the Porter-Knight racing motor varies in many important respects, in the same way that the racing poppet-valve motors used generally vary in many regards from standard designs. The two-sleeve prin-



Side view of Porter-Knight which makes 100 miles an hour



Upper—Intake side of Porter-Knight racing motor. Note high mounting of carbureter and large manifold. Lower—Exhaust side of same motor, showing simplicity and accessibility. Note how manifolds fit around cylinder castings instead of bolting to them, both intake and exhaust pipes fitting into grooves in the castings as a piston ring fits into groove in the piston

ciple is used, but instead of there being but one eccentric shaft —which corresponds with the camshaft in a poppet type— there are two, located on opposite sides, one reciprocating the inner sleeve and the other the outer sleeve.

Further: In the standard Knight design these sleeves have had intake and exhaust ports near their upper ends, but Mr. Porter has, in additionn, introduced lower exhaust ports close to the lower ends of the sleeves, this being a result of experience gained last year with the Minerva-Knight cars which used this lower exhaust in the Isle of Man races. The majority of the hot exhaust escapes through this lower port leaving the upper port to serve merely for scavenging the remaining gases.

But there are other respects in which these racing Knights vary from conventional design: The intake and exhaust ports are of practically double the area and the timing of the sleeves is different so that higher efficiencies and speeds are obtained, the motors turning up to 5,000 r.p.m. in the testing room, which is a high mark in crankshaft speed and which is largely due to the enormous port areas. Coupled with these larger areas, higher efficiency has been obtained by reciprocating the sleeves only .75 inch, instead of 1 1-8 inches, accomplishing in this way quicker port openings and longer dwells with the enlarged openings.

Improved Lubrication System

There are many other respects in which the conventional has been departed from, such as an improved system of motor lubrication; the use of timing gears being necessitated instead of silent chain drive for the eccentric shafts on account of employing two of the latter; and, naturally, the very general use of the highest quality of metals respectively suited to the different parts of the motor, as well as making these as light as possible.

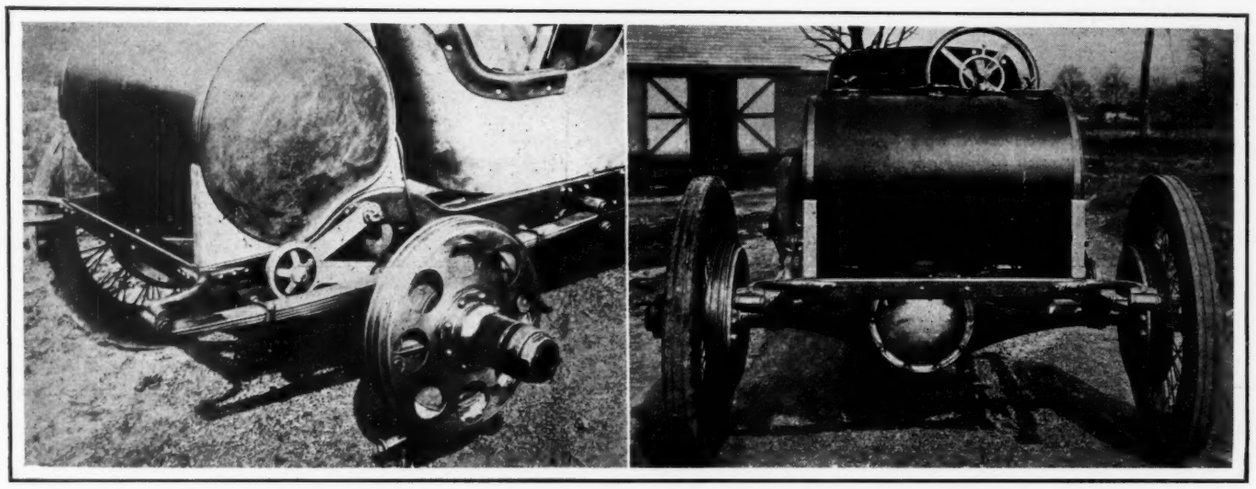
Apart from the motors, the remainder of the chassis is a result of Mr. Porter's long racing experience. In the design he has worked with three objects in mind: First comes maximum strength obtained by using only the best metals; second, minimum weight, made possible by the selection of materials; and, third, utmost simplicity of parts, largely achieved by a clear conception of design, rather than by trying to remake parts that previously existed in more or less involved forms.

122 H.P. at 3,950 R.P.M.

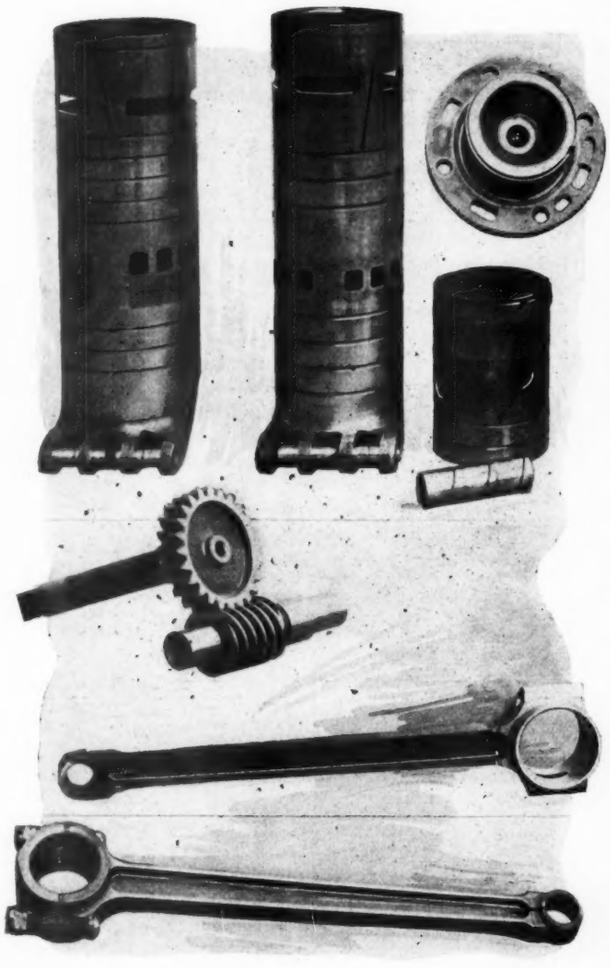
With these three objects in mind he has produced a racing creation weighing 1,910 pounds and having a four-cylinder motor 3.75 by 6.125 —3 3-4 by 6 1-8—inches, having a piston displacement of 270 cubic inches, or well under the 300-cubic inch limit of the Indianapolis race. With this motor he secures 122 horsepower at 3,950 r.p.m. With a 3 1-4 to 1 ratio on high the motor is rotating 2,650 at a speed of 85 miles per hour. At a car speed of 100 miles per hour the crankshaft speed is 3,250 r.p.m.; and at 60 miles per hour the motor speed is 1,986 r.p.m.

The chassis is built with a 110-inch wheelbase, 56-inch tread, 32 by 4 front tires and 33 by 4.5 rears. The combined gasoline and oil tank, 30 gallons of gasoline and 10 gallons of oil, is mounted transversely at the rear and no attempt is made at a streamline tail but in the general body design front-end wind area has been cut to the fifth place of decimals, metaphorically speaking. The body at its maximum measures but 30 inches overall width, yet there is ample room for the driver and mechanic who occupy staggered seats; and while the body is high, no special effort being made to keep it specially low, its lines are such as to entirely protect the driver and mechanic and eliminate any loss caused by the wind striking their heads or shoulders. The radiator is narrow and relatively high with the sides well bevelled. Wind resistance at 100 miles per hour approximates 50 pounds per square foot of front area, but Mr. Porter has in reality little or no really effective area in front. Coupled with this is the fact that the drawbar pull of the car is but 18 pounds on a level macadam road, this pull being sufficient to move the car. Mr. Porter has calculated that but 5 horsepower would be needed to propel the car at a speed of 100 miles per hour in a vacuum. On the road different conditions are met and here it is found that 98 horsepower is needed to drive the car 100 miles per hour and that 93 of this is needed to overcome wind resistance, the remaining 5 to propel the car.

Three metals are conspicuous in these machines: First comes chrome-vanadium steel which enters very generally into



Left—Rear construction, showing lightened brake drum, mounting of fuel tank, etc. Note spring horn at rear through which drive is taken instead of through front end of springs. Right—Rear view of the car, showing narrow body. Observe ribs on brake drums for strength and cooling. This view also gives an idea of the spring horn mounting



Parts of Porter-Knight racing car. Note additional ports at lower part of sleeves, a departure from usual practice. Light weight and strength characterize all the parts illustrated. In the center is the extra-strong worm and gear used in the steering mechanism. The length of the connecting-rods is about two and a half times the motor stroke

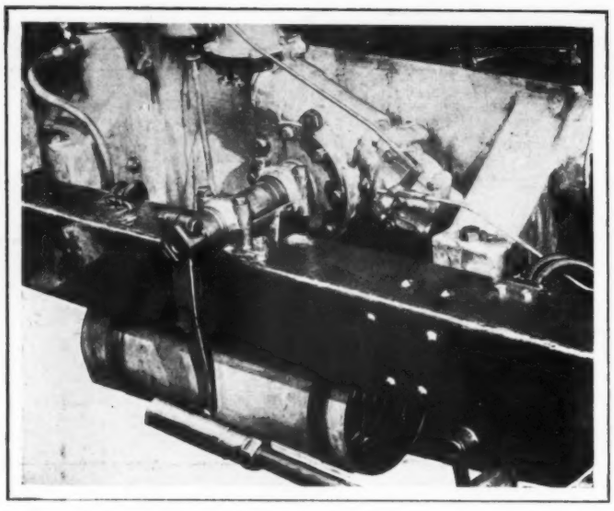
parts; second, air-hardened steel used for gears and where it is desired to get great hardness and yet avoid the dangers of warping in manufacture; and third magnalium with its strength factor combined with light weight. Chrome vanadium is used in the frame, front axle, crankshaft, eccentric shafts, shafts of gearbox, rear axle, propeller shaft, wristpins, etc. Air hardened steel, a metal very rarely used in this field, is employed in gears and a few other places. It is a government product used in projectile manufacture. Its chief merit for use in an automobile lies in the fact that it is very easy to heat treat and because of this avoids warping in the heat treatment of gears. With air-hardened steel in the heat treatment process you heat to 1,500 degrees F. or thereabouts, using only one treatment as compared with some alloy steels which are heated to 1,700 or 1,750 F. after which there is a reheat and a drawing accompanied by the possibility of warping. Air-hardened steel is in reality a tungsten alloy. Magnalium is used in several parts where strength is not the prime consideration, an example being the carrier for the differential, this carrier fitting into the pressed steel rear axle housing.

Metal Selection Saves Weight

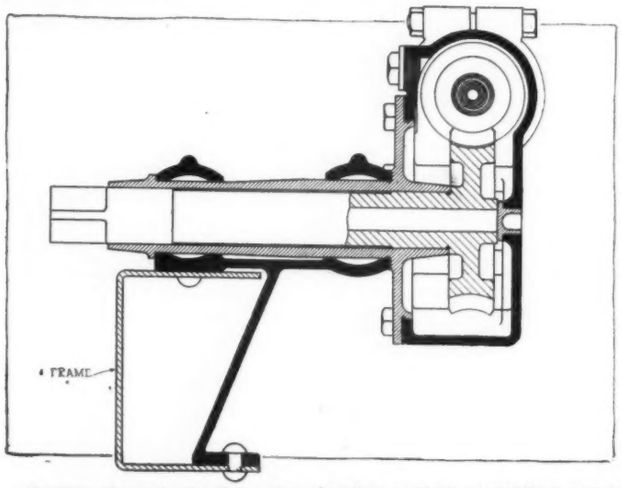
By the careful selection of metals much weight has been saved. In the differential alone there is a weight of 46 pounds as compared with the standard types. The total rear axle weight is but 180 pounds, this including brake drums and everything but the wheels and tires. The four-speed gearbox, including the brake drum on the rear of it, weighs 90 pounds. There is a saving of 9 pounds in the two universal joints in the propeller shaft. Added to these are many other examples of weight reduction accomplished by hollow propeller shaft, light connecting rods, pistons, etc.

Before taking up the detail questions of design involved in the motor, gearbox and other car parts, one other example of care in design crops out, and one which may have a bearing on future racing on speedways. Up to this time it has been considered that a two-speed gearbox is sufficient for speedway racing and that considerable weight could thus be saved. A four-speed set is used on the Porter-Knights, due primarily to the use of a very small motor, 270 cubic inches. European practice has been to increase the number of gearbox speeds as the motor displacement has been cut down. It is figured that better acceleration will be possible with a four-speed set and the motor kept in its range of most effective speeds. Some of the high-speed, high-efficiency European motors use five forward speeds.

The Porter-Knight motor uses four separate cylinder castings with the usual detachable heads and employs a spherical combustion chamber with a single spark plug located in the dome. Across the front is a transverse shaft carrying the



Extra-strong steering gear used on Porter-Knight racer. Note cooling coil for lubricating oil mounted under frame. This is part of the circulating system



Section through steering gear, showing method of rigidly bracing to frame. A Z-shaped piece of steel is riveted by a single rivet each to the top and bottom of the channel

Bosch ZR-4 magneto on one end and the water pump on the other, thus leaving both sides of the motor clear, except for the carbureter, which is positioned above the steering gear on the right side. The crankcase is an aluminum casting supported rather unusually at three points, two rigid arm supports to the frame on the right side and a central trunnion in the middle of the right side. This disposition of the three supporting points is preferred to using the trunnion at the forward end and the rigid points oppositely at the rear, as less strain is transmitted from the frame to the case and consequently to the crankshaft bearings.

Manifolds Not Bolted On

Most conspicuous about the motor is the attachment of the intake and exhaust manifolds, which, instead of bolting to their respective sides of the cylinder castings fit around the castings the same as a piston ring fits into its groove in the piston. Each cylinder casting has two grooves around its exterior, the bottom groove being for the main exhaust manifold and the top groove for the intake and scavenging exhaust manifolds. Into these grooves the manifolds fit and the air-tight fit is by the castings bearing against the top and bottom of the groove just as a piston ring fits to prevent gas leakage. The large main exhaust manifold is in halves, one half on each side, and these are held together by transverse bolts extending from side to side between the cylinder castings and by shorter bolts at the ends. The combination top manifold is similarly secured.

The cylinder castings are a fine grade of gray iron, water-jacketed throughout their length and with a casting thickness of 3-32 inch outside the jacket and 1-4 inch between the jacket and the cylinder. The crankshaft is counterbalanced with crescent-shaped integral weights to counteract centrifugal force and thus impose less stress on the three bearings. These bearings are all 2 1-4 inches in diameter and have the folowing lengths: Front 3 1-4 inches, center 3 inches, and rear 4.5 inches. The bushings are bronze shells faced with a very thin layer of white brass, 1-32 inch thick, the aim being to have the white brass serve solely as an anti-friction film and, should it burn out, the damage to the shaft would be less than if a much thicker facing were used.

Connecting Rods Are Light

Connecting-rods are cut from solid billets of chrome-vanadium and when complete weighs 2 pounds, 3 ounces without the bushings but with cap and bolt. They measure 15 inches center to center, which is about two and a half times the piston stroke, this being a higher ratio than generally used.

Pistons are particularly thin steel castings carrying two rings in one groove near the top. The usual perforations to reduce weight are not used but the weight cut to 2 pounds 4 ounces by cutting the thickness of the plain part of the piston to 1-16 inch. The length is 4 3-4 inches, top clearance .025 inch and at the bottom .015 inch. The wristpin is a 1-inch chrome-vanadium tube which clamps into the top end of the connecting-rod.

The two reciprocating sleeves are domestic castings using iron with a high graphitic carbon. The inner sleeve is 5-32 inch thick and the outer one 1-8 inch.

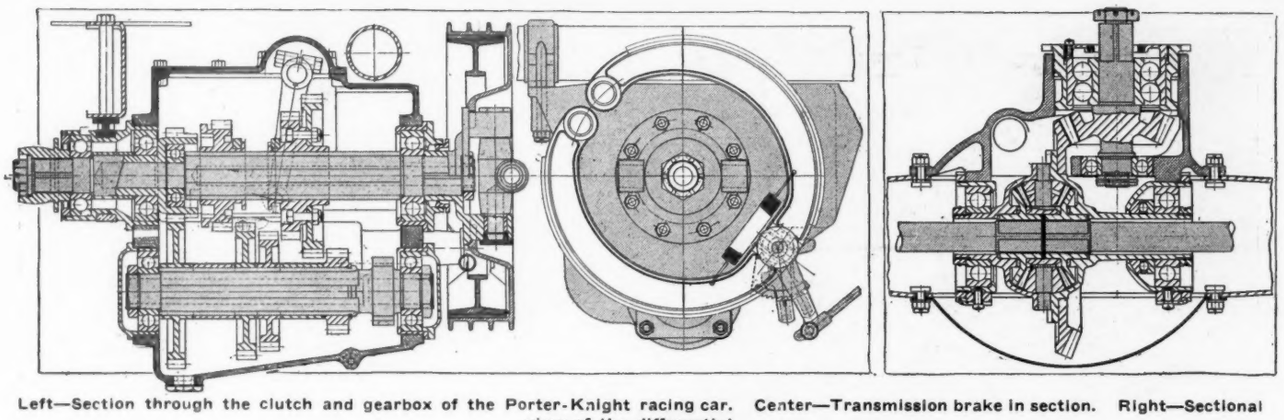
Port areas are prime essentials and these are large. The intake port for each cylinder has an available area of 3.14 square inches; the lower exhaust port area is 4.86 square inches; and the top exhaust port 1.17 square inches. The value of the large bottom exhaust port is better realized as it opens 70 degrees before bottom dead center, thus getting rid very early of the hot gases. The opening of this port is very abrupt, the sleeves having moved into the desired position so that the final opening is accomplished by the descending piston uncovering the ports.

The complete motor timing follows:

Exhaust port opens 70 degrees before bottom center.
Exhaust port closes 15 degrees past top center.
Intake port opens 5 degrees past top center.
Intake port closes 62 degrees past bottom center.

The opening of the intake port is rapid and is accomplished by the downward movement of the inner sleeve, the outer sleeve port being in position previously and waiting for the inner one. This, combined with the quick opening of the lower exhaust port, is given credit for much of the motor power.

A non-splash system of motor lubrication delivers oil under pressure to the three bearings of the crankshaft, to the lower connecting-rod bearings through the drilled crankshaft; and, lastly, direct against the piston wall by means of oil ducts leading into one side of the cylinder casting and other ducts leaving from the opposite side. The oil so entering the cylinder reaches the outer piston wall by passing through a series of oil ports in the sleeves, these ports in the two sleeves registering on the up stroke of the piston. When these ports in the sleeves are not in register the oil so fed into each cylinder finds its way around the outer sleeve to the opposite side where the exit oil duct attaches and oil so escaping from the cylinder is led onto the timing gears at the forward end and finally finds its way into the reservoir in the engine base.

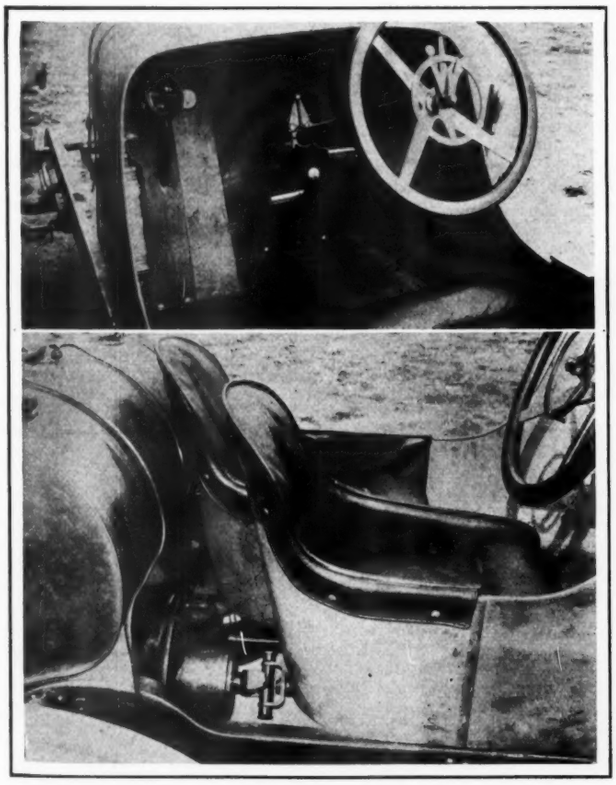


Left—Section through the clutch and gearbox of the Porter-Knight racing car. Center—Transmission brake in section. Right—Sectional view of the differential

To maintain such a system of motor lubrication two pump systems are in reality used. The primary pump system consists of a single plunger pump, operated by an eccentric, which draws the oil from the reservoir in the base through a strainer and next through an oil radiator, a cylindrical coil of .5-inch copper piping outside the crankcase. Here the oil is cooled as much as possible. Passing through this cooling coil, the oil is lifted into a secondary reservoir of 2 quarts capacity. In this reservoir is a five-plunger pump. Four of the plungers feed direct to the three crankshaft bearings and the fifth supplies the oil to the cylinder walls, already referred to. There is a separate pump for the two end crankshaft bearings and two for the center bearing.

The clutch is a cone type, the magnalium cone faced with Raybestos. The forged steel flywheel weighs 55 pounds and measures 18 3-8 inches in diameter.

The four-speed gearbox is an exceptionally compact design and is skillfully mounted at three points on two frame cross members. One end is suspended by metal straps from a tubular cross member and the other end is suspended centrally by a single stirrup from a conventional channel cross member. The gearset is a vertical design with the mainshaft directly above the secondary or layshaft. Air-hardening steel is used in the gears which are 3-4 inch face and six pitch. Direct drive is on fourth speed and the three highest ratios between the motor and rear axle are 3 1-4 to 1; 4 1-4 to 1; and 6 to 1.



Upper—Simple, clean layout of dash on the Porter-Knight racer. Lower—Staggered seats to allow the driver plenty of elbow room

Brake Behind Gearbox

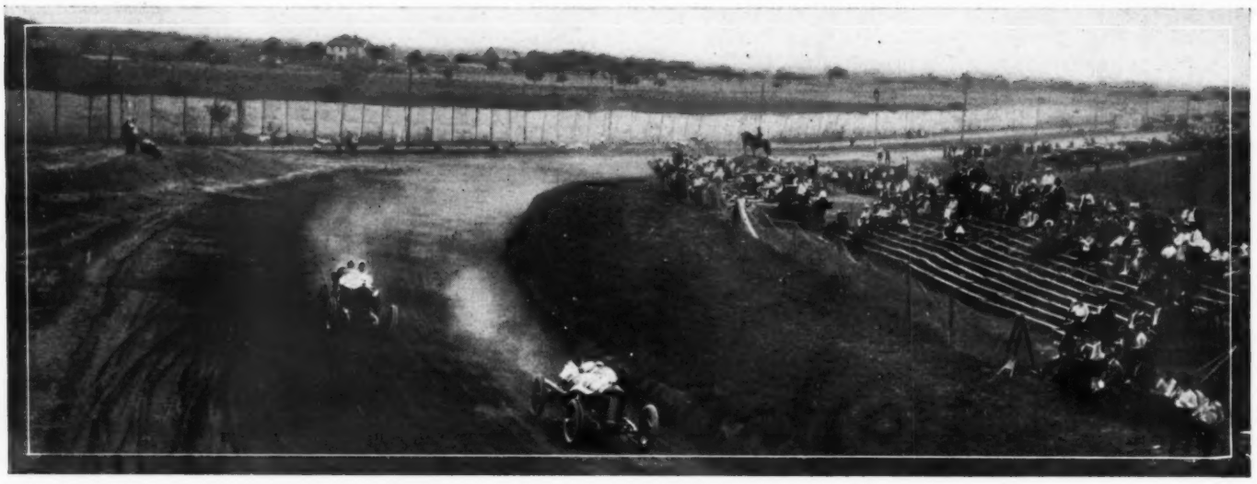
Closely associated with rear axle design is that of the brakes, of which both sets are internal expanding, one located within ribbed drums on the rear wheels and the other within a similar drum on the rear of the gearbox and pedal applied. The rear wheel brake drums are 16 inches in diameter and the expanding shoes are semi-circular magnalium castings faced with short segments of cast iron presenting a 2-inch width against the drum. Expansion of the bands is by cam with a spring release. The brake construction in rear of the differential is identical.

Front axles call for much care in racing car construction and in this case a chrome-vanadium forging is used with the steering pivots inclined backwards at an angle of 8 degrees and with an inside camber of 2.5 degrees. This combination of angle and camber gives a castor effect which gives ease of steering and tends to keep the wheels moving in a straight line. With this arrangement should the tie rod break or either tie rod arm break the loose wheel will follow the other one and so an accident is in all probability avoided.

Running Gear Details

Running gear details have come in for as generous use of alloy steels and careful construction as other car parts. The frame is chrome-vanadium 1-8-inch stock and with 4 7-16 inches vertical section. Both sets of semi-elliptic springs are practically flat, there being a camber of .5 inch on the front set, which measures 36 by 2 inches. The rear set, 46 by 2 inches, is shackled at its forward end and bolted direct to the frame horn at the rear, the reverse of general practice. This is done so that the axle in reality pulls the car through the rear end of the spring rather than pushing it through the front end, which it would do if the shackle were in rear and the bolting direct to the frame at the front end. By this reversal of general practice a steadier running is claimed with less tendency to bounce on the track.

Steering is through a worm and complete gear mounted in a manganese bronze casting, this casting being supported direct on the frame side member, with the bracket so designed that the weight is distributed on the top and bottom sides of the channel and the vertical section is not pierced by supporting bolts. This mounting has the merit of rigidity as well as conspicuous accessibility.



Burman about to pass Oldfield on Rainbow Curve in Southwest Sweepstakes at Oklahoma City. Oldfield's car is No. 1

Burman's Peugeot Wins Oklahoma Race

Covers 199.5-Mile Course at 67.98 Miles Per Hour

By C. S. Moore

Result of 200-Mile Southwest Sweepstakes

Car	Driver	Time	M.P.H.
Peugeot	Burman	2:56 3-5	67.9
Stutz	Lewis	2:57:25 1-5	67.6
Case	Raimey	3:05:41	64.7
Case	Hearne	3:08:02	63.8

Bob Burman, winner of 200-mile race at Oklahoma City

OKLAHOMA CITY, OKLA., May 1—Like a flash of lightning on the straightaways and "Wild Bob" on the sharp and treacherous curves, Burman, driving a French Peugeot, won the $5,000 200-mile Southwest Sweepstakes automobile race here Thursday afternoon, after a most spectacular duel for thirty laps of the course with Dave Lewis of the Stutz team who finished second. Burman's time for the course, which is actually 199.532 miles, was 2 hours, 56 minutes and 3-5 seconds. His average was 67.98 miles an hour. His fastest lap, his seventieth, was made in 2 minutes flat, which is traveling at the rate of 72 miles an hour. This was the official announcement. Against this were the times obtained from a score of spectators, with stop watches, who declared that Burman made the lap in 1 minute and 59 seconds, and there were a few whose time pieces said the speed demon made it in 1 second less.

Battle Between Burman and Lewis

Burman, the favorite of the majority of spectators after the first few laps, drove a wonderful race, gradually closing in on Lewis after the thirtieth lap, gaining several seconds on each by taking the turns with great daring. He had lost almost an entire lap, 2.404 miles, when forced to change a tire in the eleventh lap, but took the lead from Lewis on the seventieth round, and his advantage was increased slightly three laps later when Lewis ran off the course at Willard Hook, losing nearly a 1-2 minute. Victory for Burman was made practically certain when Lewis eased into the pits after the seventy-seventh lap, with just six more laps to go, for a new tire.

A crowd estimated at between 12,000 and 15,000, saw the race, the first really big automobile race ever staged in this part of the country. The grand stand was packed, and the whole course was lined with spectators. Great throngs gathered at Willard Hook and Rainbow curve, the sharpest and most dangerous places on the curve.

Only two slight accidents marred the event. Scott's Tulsa car jumped the course and crashed into a tree in the very first lap. Scott was slightly cut on the top of his head, and his mechanician was scratched on several places about his face. Neither was hurt to any serious extent. Earl Cooper in a Stutz, in his twenty-eighth lap struck the inside bank on Rainbow curve while going at 65 miles an hour and his car was disabled. Both Scott and Cooper were forced out of the race. Cooper limped into the pit. Scott and mechanician deserted their car at Willard Hook, where the machine plunged into the tree going at a terrific speed. Spectators said the driver went too far toward the outer edge of the

curve and that when his machine started to skid he had no control over it whatever.

Of the eleven cars starting just seven finished.

Here is the way the drivers were numbered when the race started:

1. Maxwell, Oldfield, driving; Goetz, mechanic.
2. Maxwell, Carlson, Frazen.
3. Simplex, Disbrow, Needham.
4. Case, Raimey, Moore.
5. Case, Hearne, Le Corq.
6. Peugeot, Burman, Haibe.
7. Stutz, Lewis, Devore.
8. Stutz, Cooper, Dutton.
9. Mercedes, Clark, Reese.
10. Stafford, Striegel, Day.
11. Tulsa, Scott, Combs.

The cars started in this order: 10 and 4; 3 and 8; 6 and 5; 7 and 2; 1 and 9; 11, all being paired except the Tulsa car. The starts were 20 seconds apart.

John Raimey in a Case was in the lead for the first few laps, but Billy Carlson in a Maxwell soon overtook him. Carlson well led the field during the first twenty-five laps, and even in the twenty-eighth when he went out of the race on account of a burned bearing, he was a few seconds in the lead. Louis Disbrow in a Simplex was second for a short distance, but soon fell behind.

Burman, running steadily and close up, was thrown back to eighth place after the eleventh lap when he stopped for a new tire. He had picked up a nail on Rainbow curve. According to the official timer, the change of tire took 31 2-5 seconds.

Earl Cooper was forcing rapidly to the front in the few laps just preceding the accident that left his car a hopeless wreck insofar as that race was concerned. But as he gave up the lead his teammate, Dave Lewis, came up from behind and was soon ahead of the field. Billy Carlson stayed at the front of the list until his oil supply became exhausted in the twenty-eighth lap and his bearings burned out.

Barney Oldfield dropped completely out of the running after three or four stops early in the race on account of trouble with his engine, but he refused to quit the race and was running at the finish.

Burman's Winning Spurt

The big white Stutz, driven by Dave Lewis, ran steadily in the lead from about the thirtieth lap, with Raimey, Disbrow, following, and Burman in his Peugeot taking things easy, until the forty-fifth. Then Burman passed all others except Lewis, and then he began pressing the leader. From the sixtieth lap on Burman drove at a tremendous gait until he caught and passed the flying Stutz on the straightaway on Sixteenth street, and the cheering was loud and prolonged. Lewis, perhaps a trifle excited, made victory easier for Burman when he left the course at Willard Hook on the seventy-first lap. Six laps later he was forced to the pits to change a tire, and lost nearly a full minute.

Running out of oil after going sixty-two laps, George Clark brought the old Mercedes into the pits for the first time. After the gas tank had been filled and the driver was ready to resume the race, oil that had been spilled under the car caught fire and the blaze enveloped the rear end of the machine. The conflagration was extinguished in a few moments, but the car was damaged so that either it could not be put back into the race, or Clark, realizing his hopeless chance to get inside the money, would not start again. Disbrow brought his Simplex in for a new tire after the Mercedes was out. Disbrow, noted for his daring on dirt tracks, took the turns far more easily than did several of the other drivers.

Dave Lewis, whose Stutz was second in Southwest Sweepstakes

No one realized what a handicap Burman drove under until after the race was over. When he stepped from his machine after completing the eighty-third and last lap he immediately asked for medical attention. He had driven from the seventh lap with a piece of glass lodged in his right eye, and nothing to protect the eye from the terrific pressure of the wind. The glass on the right side of Burman's goggles had been broken by a pebble hurled by the buzzing wheels of Eddie Hearne's car when Burman was passing Hearne on Rainbow curve. A peculiar feature was that when Burman's car had gone in front of Hearne's, a small stone dug out by the Peugeot's wheels flew back and broke one of the glasses in Hearne's goggles.

The $5,000 purse was officially divided by Referee Furlong, and turned over to the winners. Burman received $2,500, the winner's share; Lewis, $1,250; Raimey, $750, and Hearne, $500.

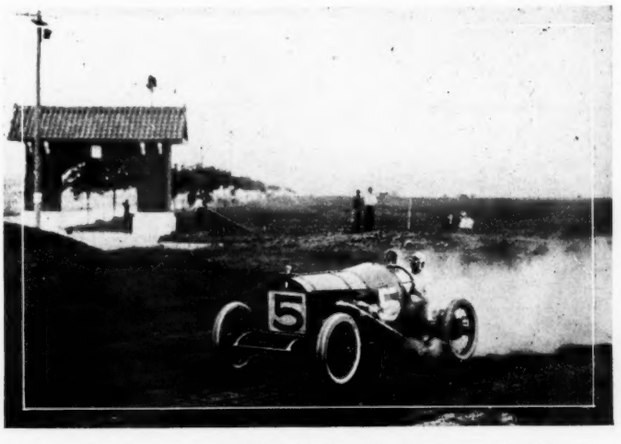
Stafford Only Non-Stop Car

Albert Striegel in a Stafford was the only one of the eleven who made the entire distance of the race without a single stop.

Beside winning the second portion of the purse, Dave Lewis won the $100 offered by the Harwell Jewelry Co. for making the fastest time for the first 100 miles. Lewis was leading Raimey by a few seconds at 100 miles. His time for the distance was 1:29:16, an average of a little more than 67 miles an hour.

Burman's peugeot, Lewis' Stutz and the two Cases which took third and fourth place, respectively, used Bosch magnetos. Burman's car was fitted with Nassau tires.

Raimey's Case on Willard Hook. Raimey took third place



Eddie Hearne on Willard Hook. His Case was fourth

Steel—

Its Pathology

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Part IV

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Specification and Price Determine Car Makers' Selection

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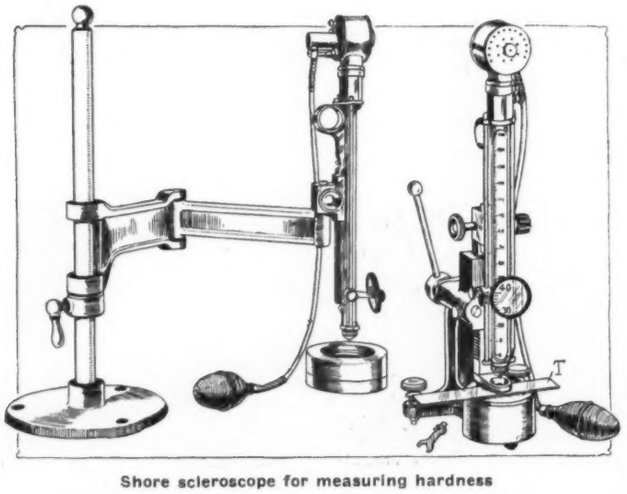
By J. Edward Schipper

THE patient has been cured. After the doctor has prescribed the proper treatment and the patient has fully recuperated and reached a state of perfect health, he goes forth to join the ranks of his fellow men and to seek employment. When this man, together with all the others in the same condition, is examined with a view towards taking a position, there are just two questions determining whether or not he will be employed. First, are his qualifications correct for the particular work in hand? And secondly, is the amount of payment he exacts commensurate with the work he can perform?

Directly parallel is the chain of events which occurs upon the discharge of a steel from the metallurgist's hospital ward. The steel has been properly treated from the medicinal standpoint by having its impurities removed and definite qualities imparted to it by the use of alloying substances. It has been rendered uniform in structure and of the proper degree of hardness by heat treatment. It is now in the position of the patient whom the doctor has discharged. It is seeking a job and, like the man, must have the two necessary qualifications before it can find one: It must possess certain definite qualities which render it suitable for the particular work, and the price must be commensurate with the work it can perform.

Two Factors—Specification and Price

In steel two requisites alone determine its selection by the automobile manufacturer; specification and price. When a man buys a steel he cares only in a secondary manner for its chemical specifications. What he wants to know is, what are its physical properties and what is its cost as compared with other metals of different specifications? If there were two metals with exactly the same physical qualities, the cheaper would be just as good as the more expensive. If a certain set of specifications will completely fill the bill of requirements for a certain definite job there is no necessity of going to a greater expense to buy a steel which will be much stronger and much better than that originally selected. We do not use gold for electric light fixtures, headlights and various other fittings and decorations—we use brass. Gold would be a more decorative material but it costs too much. Similarly there are many metals that are used throughout the automobile that fill the bill perfectly but are neither the most costly nor the strongest.



Shore scleroscope for measuring hardness

All that is required in any structural material is that it be sufficiently strong with a reasonable margin of safety, the margin of safety being the ultimate strength of the material divided by its required strength. For example: If a certain beam sustained a weight of 1,000 pounds and were capable of bearing a weight of 10,000 pounds before failure, it would have a factor of safety of 10. Factors of safety as high as this are not necessary in many automobile parts; in fact, where it is desired to cut weight to the lowest limit, as in automobile practice, factors of safety must suffer and therefore the material must be reliable.

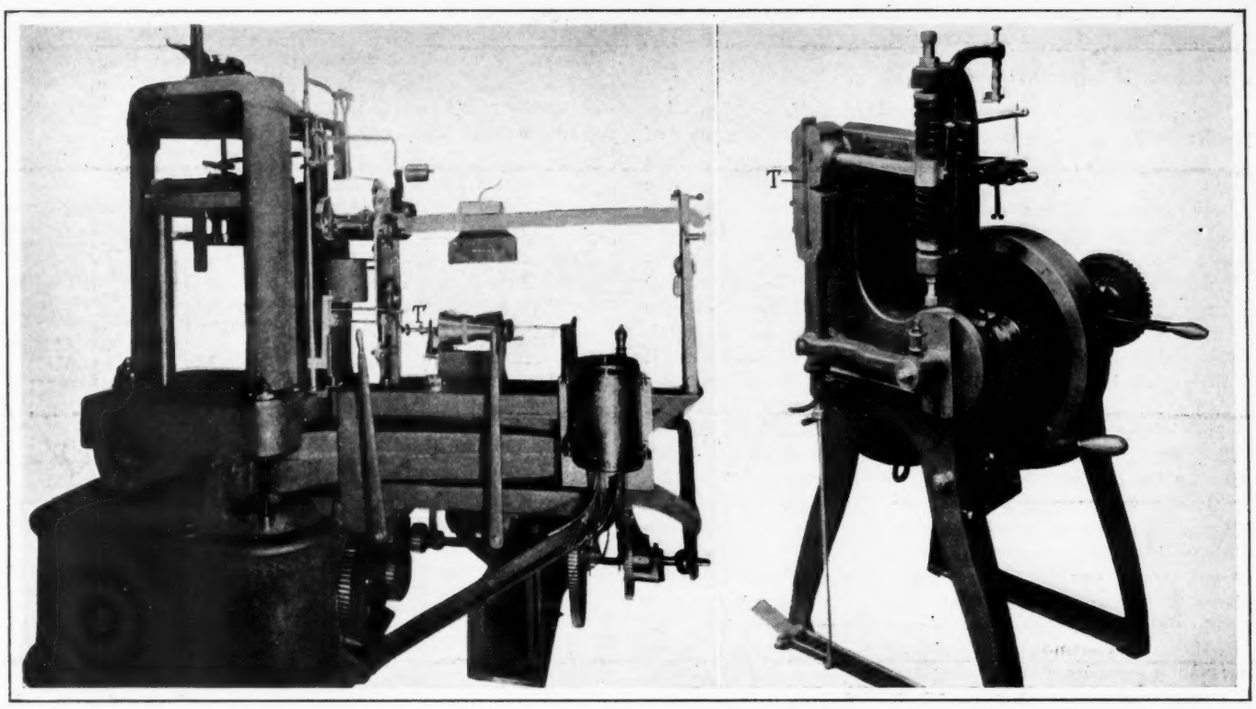
The engineer calculates the stresses which will fall upon definite parts, multiplies them by what he considers to be the proper factor of safety and then sets out to seek the cheapest material that will fill his specifications. He is like the man who seeks to hire a person for a responsible position; he knows the actual daily requirements which this man will have to meet, but in determining upon the employee, he goes further and seeks a man whose knowledge is not only confined to the narrow limit of the particular job, but who has a sufficient factor of safety in knowledge and health to assure him that emergencies will be adequately met.

Qualifications Determine Life's Work

A man may have great administrative ability, he may have a great mind for detail work, he may have a great knowledge of a particular field and be well suited for consulting work, or, on the other hand, he may be of great physical strength and well suited for physical labor. These are qualities which would enter into the choice of this man for a particular job.

In the choice of a steel there are five primary qualities ordinarily desired either singly or together. These are hardness, toughness, malleability, ability to resist shock and the ability to resist heat.

Other than these there are secondary requirements for certain definite purposes, such as, for example, retentivity of magnetism, small co-efficients of expansion, friction, heat, etc.



Left—Tinius Olsen testing machine for tensile strength. Right—Olsen testing machine for resistance to fatigue. T shows test pieces

The alloying substances and the heat-treatment whose principles have been explained, have determined these qualities, and it is now time to settle upon the particular metal desired.

In positions of ordinary stress the particular specifications desired can be reached by simply varying the carbon content of an unalloyed simple steel. For a part where ductility is required, the carbon content will be quite low, possibly around .10 per cent. At the other extremity of the scale is the part where great hardness is desired. Here the carbon content will be high, possibly .8 per cent. These are the limits for structural use and higher carbon contents are only used for special tools, etc. Where the greatest possible hardness and toughness are desired without an undesirable amount of brittleness, we might expect the carbon content to approach .40 per cent. Thus by varying the carbon content alone of a simple steel, ordinary conditions can be met.

Often, however, alloy steels will be necessary. In parts where hardness is required and yet where it is essential that absolutely no chances of fracture through brittleness will occur, it is necessary to use alloys such as chromium or tungsten. Where great endurance and strength are necessary, nickel and chromium will be found, and so on through the gamut of special steels. The duties which a part has to fulfill in taking up its post of responsibility on the car, determine the stresses that it must endure and these in turn are the factors in the selection of the steel. It will be interesting to trace how these problems are met in the transmission of power from the cylinder of a car to the rear wheels.

In an automobile, each part which is made of steel has its own peculiar stresses to bear and which therefore determine the physical characteristics that the metal must have. Following through the transmission of power from the moment the charge is exploded, the impulse is first transmitted through the piston, then to the wristpin, then to the connecting-rod, the crankshaft, the clutch, the gearset, the driveshaft, the rear axle gears, differential, axle shafts, and finally through the wheel. Each of these parts receives the impulse in its own definite manner.

The piston receives the thrust of the exploded charge on its head and must be strong enough to bear this thrust and at the same time have the peculiar quality of being able to slide freely in the cylinder. Since the area upon which the thrust is received is comparatively large—a 4-inch piston has an area of 12.566 square inches—cast iron will do. The thrust upon each unit area of the piston is not so great.

On the other hand all this thrust is concentrated upon the much lesser area of the wristpin and thus this pin, the first steel part to be met in the drive in the conventional car, must have strength to withstand the continuous hammer of the exploding gas upon the piston.

Wristpin Is a Simple Beam

The wristpin is technically referred to as a beam supported at two points. It is one of the peculiarities of this type of beam that it must resist bending stresses. Steel tubing of medium carbon content is frequently chosen for this work. The medium carbon somewhere in the neighborhood of .30 per cent. gives the necessary hardness and the tubular section gives great resistance to bending stresses. The wear of the upper connecting-rod bearing on the wristpin is guarded against by case-hardening the pin in most designs, thus giving the hard highly-carboned shell which resists abrasion.

The next step in the power transmission, the connecting-rod, has entirely different duties to perform. Here a comparatively long rod must stand great thrusts along its length. Stiffness is its great factor and there are many ways by which manufacturers of motors reach the desired end. Few use an alloy steel. Most manufacturers secure the stiffness in the ordinary carbon steel, which has between .25 and .35 per cent. carbon, by the heat-treatment. The tensile strength of the connecting-rod does not have to be remarkably high and prominent makers use a steel which does not run over 70,000 pounds per square inch. In a steel of this kind the carbon content is about .30 per cent., the manganese .65, the phosphorus not above .045 and the sulphur not above .05 per cent.

To secure the stiffness the heat-treatment is such that a good, close grain structure is provided, and in addition, the shape of the section is such as to offer the greatest resistance

to bending in the direction which the bending stresses take in imparting the thrust upon the piston to the crankshaft.

Crankshaft Is Important

The crankshaft is the next important unit. Perhaps beyond all others, it is where the study of the qualifications of the material is of the greatest importance. The crankshaft must be stiff or the motor will vibrate. It must have the power to transmit the great impulses of the cylinders through the rest of the transmission system without distorting, and hence stiffness is the great factor desired above all others. It is not necessary for its tensile strength to be remarkably high, as the greatest stresses upon it do not tend to pull the metal apart, but it must have every possible means of resistance against being thrown out of line either by the forces it transmits or by its great enemy, centrifugal force.

Alloy steels are not generally employed in crankshafts, although many makers believe in their use. The general method is to use the highest possible carbon content without running the danger of brittleness and then by careful heat-treatment, to thoroughly unify the structure.

Crankshaft steels have generally a carbon percentage as high as .40. Some go as high as .50 per cent. but this is approaching the danger line of brittleness and none is found above this mark. The tensile strength of such a steel is rarely found to be above 90,000 pounds per square inch, but after careful heat-treating, great rigidity is imparted to the finished shaft.

The use of high-carbon steel, unalloyed, for crankshafts, although far in the majority, is not universal. Alloy steels have been making their way into this field within the last 2 or 3 years. One concern uses chrome-nickel, another chrome-vanadium, and the reasons they advance for this bring us directly back to the qualities of these alloys as explained in the previous parts of this series. Chromium is found in both these examples and, as has been explained, it is the bone-builder. It enables great shocks to be withstood and hence, in a crankshaft, it would impart the strength necessary to withstand violent knocks, backfires and other stresses which would tend to break the shaft. Nickel, the muscle-builder, would tend to make the steel shaft stronger and permit a smaller shaft to impart the same turning effort that a larger one of carbon steel would be able to do. But, on the other hand, chrome-nickel steel is much more expensive

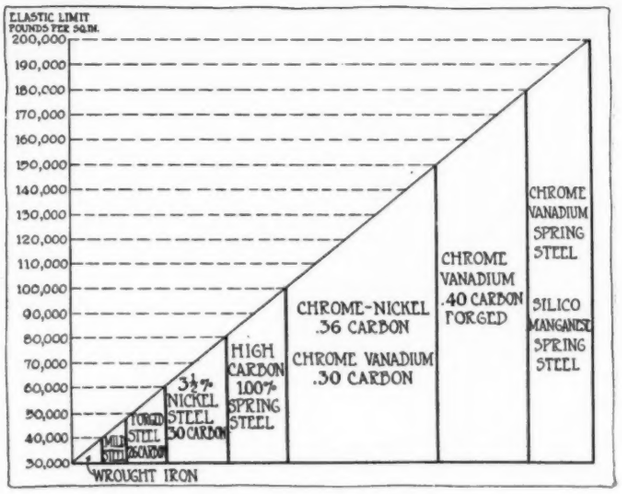
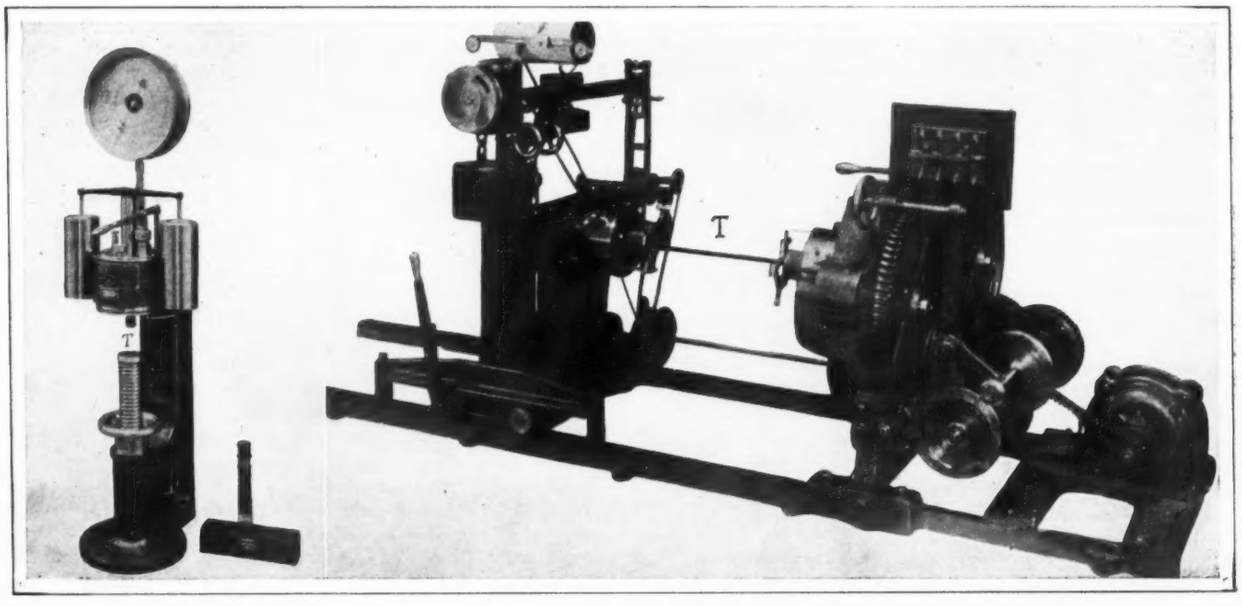


Chart showing range of elastic limit of some of the representative steels in common use

than carbon-steel and the question is whether or not it is worth while to go to the expense of an alloy steel when such great satisfaction is being obtained from the carbon-steel.

Vanadium Used to Promote Endurance

The same may be said of the chrome-vanadium crankshaft. Vanadium, the great promoter of endurance, especially when in connection with chromium, would give a shaft whose life would be longer than that of simple carbon-steel. Chrome-vanadium steel is expensive as compared with carbon-steel, but some makers believe that the expense is justified while others believe that equally satisfactory results can be obtained from the less expensive material. With some, there has been an effort to bring the shaft down to a smaller diameter with the same strength in order to decrease the bearing speeds. The further away from the center of the crankshaft, the greater the linear speed of travel around the bearing and hence the smaller in diameter the shaft, the less wear on the bearing. This, then, is one of the great factors in choosing the steel for the crankshaft. Not tensile strength,



Left—Brinnell hardness machine, T shows position of test piece. Right—Olsen torsion testing machine

but stiffness and great endurance without too great a diameter are the big qualities for this work.

The next step in the transmission of power is through the blades of the clutch. If it is a multiple-disk clutch the steel plates are called upon to transmit the entire power of the motor, but since the plates are of great diameter, relatively speaking, no great strength is necessary here. Thus, alloy steel would not be expected, neither would great tensile strength. Hardness might be in some designs, but not in all, and therefore, although it is universal to use a simple carbon steel, for clutch disks the carbon content varies greatly with the design of the clutch and upon the hardness necessary. In one clutch plate, the carbon percentage is .85, in another .10. Both of these are from representative cars and show the great variety in hardness of the clutch plates. Where the low carbon is used, case-hardening is often resorted to and in that case the carbon percentage of the shell about the metal will be very high.

Driveshaft Under Torsion Stress

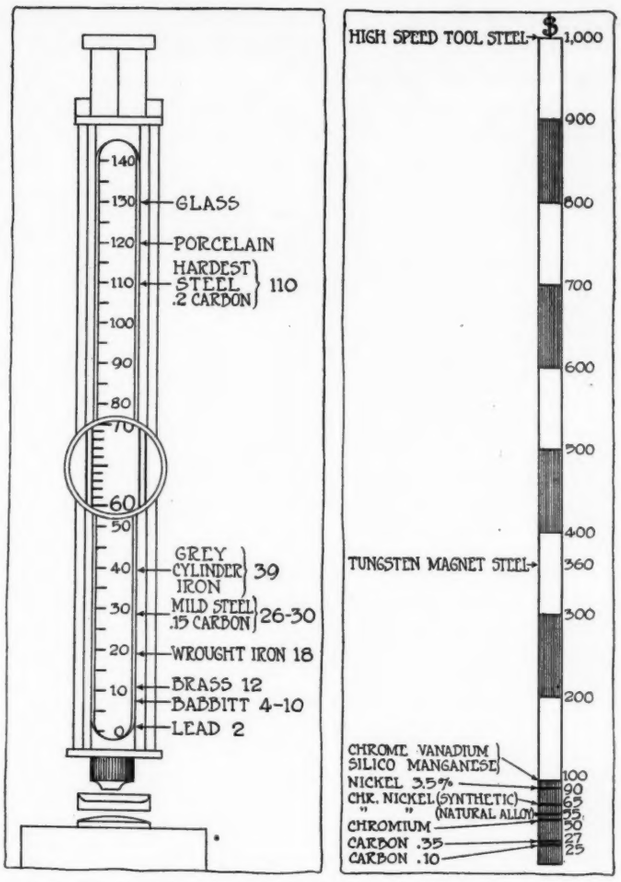
The next step of importance in the drive is in the change-speed gears. Here a great variety of stresses must be borne. Great torque must be transmitted through small teeth; great wearing stresses must be met due to the constant abrasion of tooth upon tooth; great shocks must be borne in sudden starting and stopping; therefore, it is not surprising that the use of alloy steel is practically universal at this point. Representative makers use chrome-nickel, chrome-vanadium, and nickel steels. Here the qualities of hardness and great tensile strength must be found, hence the alloys nickel and chromium. Great endurance is needed, hence some turn towards vanadium. Great toughness is desired, hence heat-treatments, which will produce great tensile strength, are required. One maker using a .50 per cent. carbon chrome-nickel open-hearth steel, hardened and oil tempered, has gears which show a tensile strength of 223,000 pounds to the square inch.

Chromium in the Gears

The use of the chromium in these gears enables the hard steel to withstand the shocks of gearshifting without chipping. Gears of this steel defy the sledge hammer in the hands of a man of more than ordinary strength and cannot be chipped or battered. The nickel promotes the toughness and this is the factor which produces the great tensile strength.

TENSILE STRENGTH IN POUNDS PER SQUARE INCH
50,000
100,000
150,000
200,000
WROT. IRON .05 CAR. 49,500
MILD STEEL .18 CARBON 60,500
VA. STEEL CASTING .10 CARBON 70,000
FORGING STEEL .26 CARBON 77,000
CR. VA. CASTING .57 CARBON 93,000
CR. VA. SPRING STEEL .40 CARBON 100,500
SPRING STEEL 1.00 CARBON 125,000
CHROME NICKEL VANADIUM STEEL .57 CARBON 129,000
NICKEL VANADIUM STEEL .24 CARBON 134,500
CHROME NICKEL STEEL .36 CARBON 150,000
CHROME NICKEL VANADIUM STEEL .30 CARBON 160,000
CHROME VANADIUM STEEL .40 CARBON 187,500
CHROME VANADIUM SPRING STEEL .40 CARBON 208,500
CHROME NICKEL OPEN HEARTH STEEL .30 CARBON 225,000

Chart showing tensile strengths of representative steels in common use in automobile practice



Hardness of different materials as measured on the Shore scleroscope. Right—Chart of prices of automobile steels. These prices are average quotations based on an order of 100 tons of 2-inch round annealed bar. They include S. A. E. specifications numbers 1,010, 1,035, 2,330, 3,130, 5,165, 6,135 and 9,250. Also high-speed tool steel and magnet steel. The prices are for a 2,000-pound ton

The vanadium is a helper towards endurance. Not all makers, however, use these expensive materials but here again carbon-steel is sometimes employed with the reliance placed upon careful heat-treating and hardening. But this is not so to the same extent that it is in crankshaft work, where it can properly be stated that only a minority use alloy steel.

The Driveshaft Problem

The next step, the driveshaft, presents a different problem. Here is a long straight shaft through which the entire drive must be taken. It must resist torsional strains, and therefore, in order to do this, it must be tough. Nickel is the great toughener and nickel is found in practically all driveshafts, with the exceptions being very few. The merits of 3 1-2 per cent. nickel-steel for transmitting the drive are universally recognized. Others go a step further and introduce chromium with their nickel to harden the steel and to help it in withstanding bending stresses. The chrome-nickel, therefore, and nickel-steel are the great driveshafts steels.

Alloys for Emergencies in Drive

The problems of the remaining drive parts are similar to those considered. The gears in the rear axle have to meet the same problem as those of the gearboxes, and consequently are composed of much the same material. Similarly the rear axle shafts perform the same duties as the main driveshafts and consequently the material in these is very much the same as in the main driveshafts. Thus the alloys are introduced into the steels in the drive to meet the emergencies, where

greater toughness, hardness and strength are needed than in ordinary circumstances.

Static Strains Are Factors

Dynamic stresses alone have so far been considered. The steels in the drive are under motion but yet there are many other steel parts about the car which have to bear static strains. The frame, for instance, and the front axle are good examples of these. As pointed out, it is desired to make the car as light as possible and these stationary parts are the ones which suffer frequently, their specifications being shaved to the limit. One of the great means at the disposal of the designer to lighten these parts, and yet keep them as strong as possible, is in the use of alloy-steels, but the cost of these is so far above carbon-steels that it is only in the most expensive cars that it is possible to use them profitably.

Low-Carbon Steel for Frames

By far the greatest majority of automobile makers use a low-carbon-steel for frames. They are low in carbon so that the frames can be worked cold, most of the channel sections employed being cold-rolled stock having a carbon percentage of .20. With this steel the channel must be much deeper and much heavier than would be the case with a high-priced nickel-steel for instance, but it is cheaper and hence most commonly employed, giving a sufficiency of strength while the difference in weight is not to be considered in any degree disastrous. The front axle offers a similar condition. Here the carbon steel is also most employed because it is cheaper, although a certain car of low price uses a vanadium steel in order to gain lightness and strength. The percentage of makers who use alloy-steels in the front axle is much greater than those using alloy-steels in the frame, but, nevertheless, the carbon-steels are greatly in the ascendency.

Cost the All-Important Factor

These examples considered give an idea of the stresses to be met in examples throughout the car. Each represents a job for the steel to perform and, like the man who started out to seek employment, the steel must meet these requirements and at the same time be economical. The great question is, "What does it cost?" and the answer is a variable one for steels owing to the fluctuations in market price and the law of supply and demand. Certain facts hold good though, as regards the prices of the different steels, and a summary of what has been paid for the different steels considered will answer to a large extent the question of why a given steel was picked out for a given purpose. This, in connection with the tabulation of strengths of the different steels, forms the answer to each problem which presents itself.

The Question of Price

As in most other products on the open market, the price of steel will vary to a large extent with the amount ordered. It will also vary in the alloy steels very substantially with the rises and falls in the prices of the alloying substances. For instance, chromium and other substances are now rather hard to secure, owing to the war conditions, and therefore the prices of the alloy steels which involve their use have risen. An idea of the prices on the steels, however, may be given, not as a practical market quotation, but as a guide on the relative prices for the different steels.

Ordinary low-carbon steel with a specification of carbon at .10, phosphorus .045, sulphur .05, may be expected to sell for around 1.25 cents per pound, or $25 per ton. It may be quoted less than this or at times more. But this is a fair value. If the formula is kept the same but the carbon raised to .35 per cent., the price would be perhaps 1.35 cents per pound or $27 per ton.

Nickel-steel is perhaps the most expensive of all the commonly used steels for automobile structural work. A common price for it is 4.5 cents per pound. This corresponds to the price which is quoted at times for S. A. E. specification 2,330 which has a .30 percentage of carbon, a .65 percentage of manganese, .04 phosphorus, .045 sulphur, and 3.5 per cent nickel. This steel would sell at $90 per ton at this rate.

Standardize Heat-Treatment

The physical qualities of the different steels will vary greatly with the heat-treatment, and in order to obtain uniform results, manufacturers are now aiding to standardize certain heat-treatment for definite composition. The Society of Automobile Engineers has gone into this work thoroughly and it will not be long before the Standards Committee of this society will publish a list of physical specifications for each of the S. A. E. steels.

Thus we have come finally to the factors in the selection of the steel. It has been shown how the metallurgist, like the doctor of medicine, analyzes the structure of the substances with which he is dealing and then, by carefully manipulating his prescriptions, surgical operations and physical exercise, brings the patient to a state of health where he is qualified to go out and meet the requirements of labor. So the steel has had its impurities removed, it has had health-giving elements added to it and finally, by the bath of flame, has been rendered fit for arduous duty. It is now in a position to prove that, by reason of its strength, and by reason of its relative price, it is the fitting material to be given a definite duty in the structure of the automobile.

Silico-Manganese Used for Springs

One steel which is often quoted for automobile use in springs is silico-manganese. This frequently sells for about 5 cents per pound, or $100 per ton. The steel in question is the S. A. E. No. 9,250, and has from .45 to .55 carbon, .70 manganese, .045 sulphur, .045 phosphorus and 1.95 per cent silicon. This is the one steel which is used in actual automobile parts which exceeds the 3.5 per cent. nickel in price. It is not the highest price steel by any means, as some of the special tool steels sell for as high as $1 per pound. These are special combinations of chromium and tungsten and are highly refined.

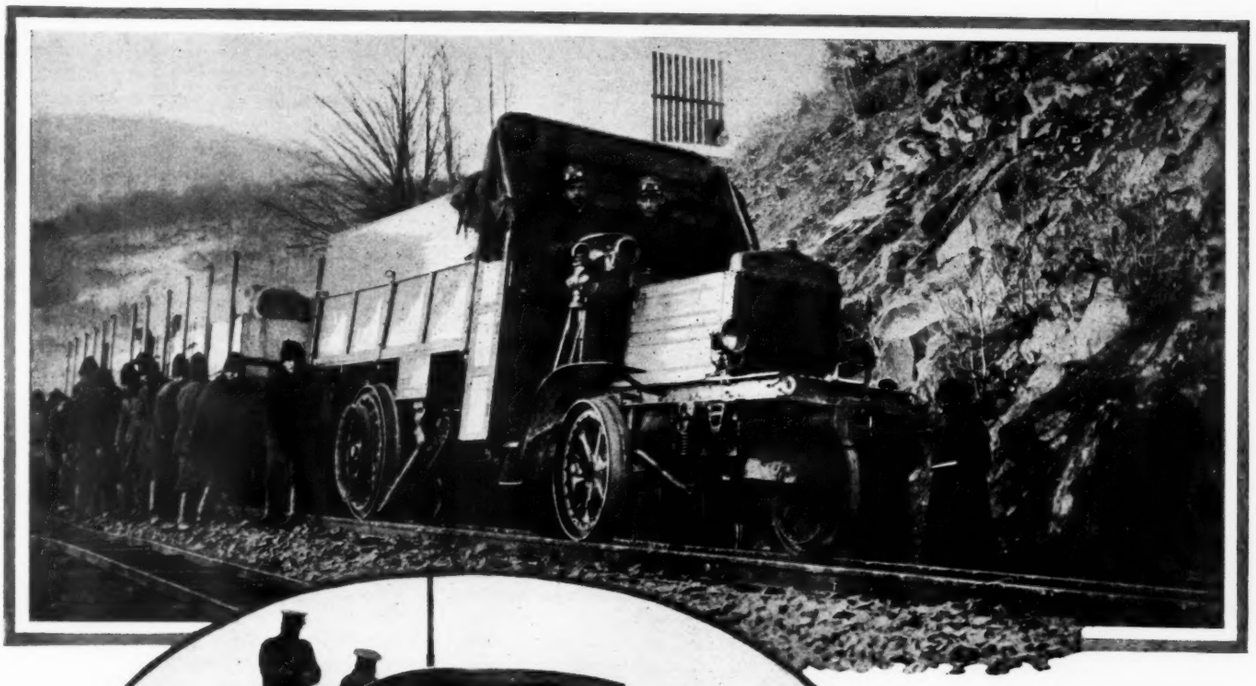
Silico-Manganese Used for Springs

Some of the chrome-nickel steels sell for sums in the neighborhood of 2.75 cents per pound or $55 a ton. Plain chrome steels will sell for $50 per ton, the difference in price being due to the expensive nickel. Chrome-vanadium steels are high priced, selling for 4.25 cents per pound or $83 a ton. These quotations would be for S. A. E. specifications No. 3,135 for the chrome-nickel, 5,140 for the chrome and 6,130 for the chrome-vanadium. The chemical specifications for these are as follows:

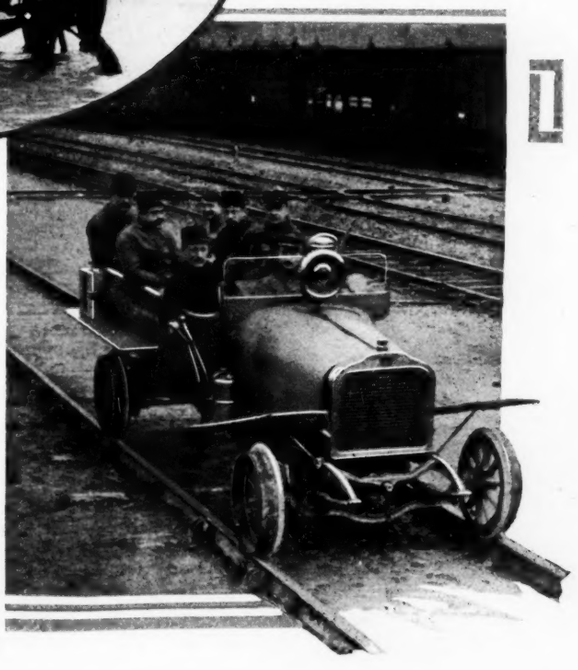
Nickel - Chromium Steel	**3,135.**	Manganese	.65
Carbon	.35	Phosphorus	.04
Manganese	.65	Sulphur	.04
Phosphorus	.04	Chromium	.95
Sulphur	.045	Vanadium	.18
Nickel	1.25	**Chromium Steel**	**5,140.**
Chromium	.60	Carbon	.40
Chrome - Vanadium Steel	**6,130.**	Manganese	.35
Carbon	.30	Phosphorus	.04
		Sulphur	.045
		Chromium	.75

This is the concluding article of a series of four dealing with steel. The first part dealt with the impurities and the constituents which are always found in any steel. The second dealt with the alloying substances added to give special qualities. The third, with the heat treatment and the fourth with the practical selection of the steel.—EDITOR.

Cars and Trucks Under War Conditions



Above — Austrian Army transport truck photographed in one of the defiles of the Carpathians, the battleground of the Russian and Austrian forces. Note how the wheels are flanged to run on the railway tracks.



Above—Rough seas flooding the road in the north of France. The Tommy Atkins is trying to crank the English Daimler truck, stalled in the water, but the magneto has had a bath and refuses to spark so, in spite of priming the cylinders and other methods of coaxing the motor to start, Tommy finally gives up the task, having only a ducking in the icy water for his pains.

Right—Owing to the tremendous artillery fire to which large sections of country in northern France have been subjected, as well as to the constant pounding of heavy and practically continuous traffic, roads in these regions are frequently well-nigh impassable. The illustration shows a touring car which has been altered to meet these conditions, the wheels being fitted with flanges to permit of driving the car on railway lines.

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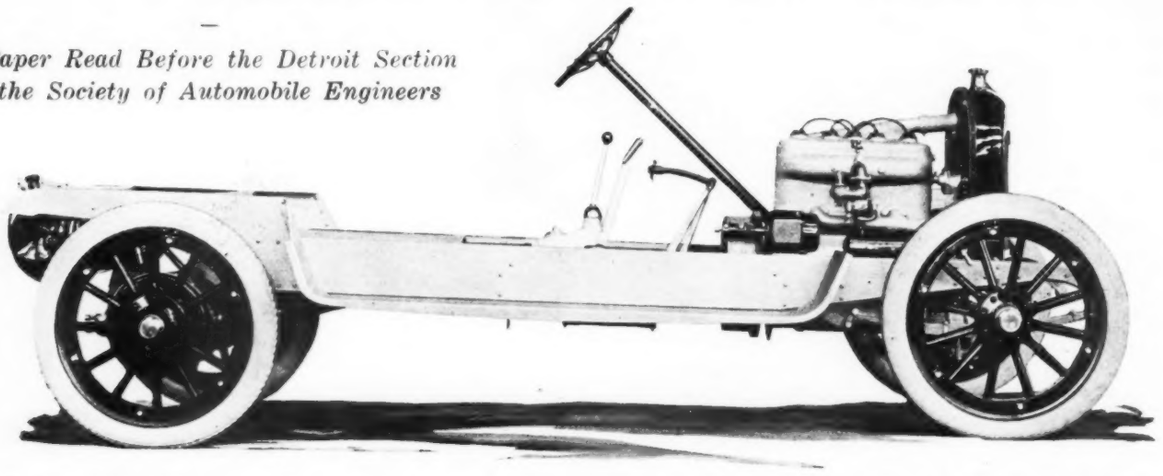
Brush Advocates Scientific Chassis

New System of Layout Based on Structural Demands Said to Increase Strength and Cut Weight

A Paper Read Before the Detroit Section of the Society of Automobile Engineers



Chassis designed according to the Brush method in which the stresses on each part alone are considered in determining the dimensions and shape

DETROIT, MICH., April 29—Before the largest attendance of the year A. P. Brush, consulting engineer, outlined new principles in automobile frame construction that proved one of the most interesting topics since the discussion on eight-cylinder motors, at the monthly meeting of the Detroit section Society of Automobile Engineers. Mr. Brush's plan of chassis construction briefly does away with the conventional running board, running board apron, step hangers and body cross section, and widens and deepens the frame so as to bring it out flush with the body sides, and using the frame itself as a substitute for the aprons. While this gives practically an identical outward appearance as compared with the standard design, it was pointed out that practically every bit of metal used is of structural value, whereas it was contended that much of the material used in the conventional chassis has no structural value whatever. That is, running board brackets, aprons, and the like, are of no use structurally. The paper follows:

I am keenly aware of the fact that it is an honor, as well as a privilege, for any man to be permitted to address a gathering of the members of the Society of Automobile Engineers.

It is a pleasure to me to know that what I have to submit for your consideration, criticism and discussion has by severe and practical tests, justified the indulgence with which you honor me this evening.

At least the older of my brother engineers can remember when they sold automobiles with the front end like a toboggan, fenders were an extra and "get-a-horse" was the latest thing in slang.

We have all heard about the fickleness of the automobile-buying public, but as I review in my mind's eye the development from those early machines to the modern streamline motor car, I am impressed by a singular consistency. It has constantly and invariably set the seal of its approval upon progress in reliability, better performance, increased comfort to the passenger and operator, and more rational—or shall I say more artistic—appearance?

Fenders became a part of the car. The old carriage step was displaced by the running board. Wheelbase began to lengthen and the single rear entrance tonneau was replaced by the double side entrance. The wheelbase continued to grow. The center of gravity was lowered. Passengers were given more leg room, more seat width, and doors were provided for the front seat.

In the main essentials, the modern car had arrived, but what a hodge-podge it was in appearance with its exposed frame and running board supports; with the seat lines and the door pillars conspicuous on the sides of the body; with the old horse-drawn vehicle's dash still in evidence, lacking only the whip socket.

The automobile-buying public may be fickle about some things, but there has been no uncertainty about its approval of the cleaning up of the exterior appearance. The running board apron, or dust shield, covering the frame and the running board supports, the flush sided body and the streamline, give a simplicity and harmony of appearance that is as inherently a part of the modern motor car as is the motor itself.

All of this progress in comfort and appearance which I have outlined, together with many other contributing details, such as shaft drive, electric lighting and starting, and increased power in proportion to the total vehicle and load weight, has not been secured without sacrifice.

Weight Increase Has Occurred

In spite of better materials and in spite of better knowledge and experience in the proportioning of parts, the development of the motor vehicle has been accompanied by an increase in the weight of that vehicle.

This increase in weight, while partly due to increased size and power, is also partly due to the fact that the main structural elements of the chassis have remained substantially without change for the past 12 years, and the profound change in appearance and equipment which has taken place during that period has been secured largely by the addition and elaboration of parts which, structurally speaking, are so much junk.

There may be legitimate differences of opinion as to types of motors, as to lengths of wheelbase, and there may be legitimate differences of opinion on a thousand and one other details of motor car construction and proportion, but I believe there is no difference of opinion to be found anywhere as to the advantages to be secured by a reduction in the weight of a vehicle, provided such weight reduction can be secured without increasing the cost of the vehicle and without sacrificing any of the qualities which appeal to the user.

In outlining for your consideration a method of reducing the weight of this so-called pleasure vehicle, I realize fully that the suggestions would be of little or no value if they involved any considerable increase in cost; if they involved any weakening of the structure or if they involved any increase in what may be characterized as the road noises of the vehicle.

On the contrary, I feel justified in the unqualified assertion that the suggestions which I wish to present to you are advantageous at every point to the car builder and to the car user.

It is a matter of approximately 3 years since it began to be borne in upon me that the trend in the appearance of the motor car was toward a final form which would enable the structural elements of the car to be so made that a distinct gain in strength could be secured, accompanied by the elimination of a considerable amount of material, which, in conventional construction, has no structural or strength value, its only use being to secure the required appearance.

I have refrained from presenting this plan for an improved type of construction to the society until I could speak with certainty as to its proven value.

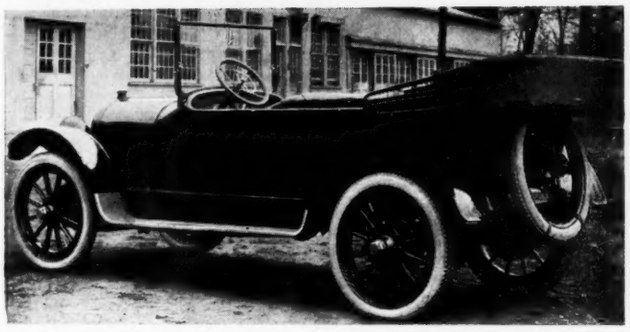
I have had prepared a number of drawings which illustrate the principles involved, and to some extent to make plain the latitude which these principles of construction allow the individual engineer in working out his own particular problem. You will agree with me that these charts illustrate a more scientific arrangement of the material used in securing in a car structure that combination of strength necessary to make a durable vehicle and that clean simplicity of appearance which is so essentially a part of the modern and future motor car.

Design Has Been Tested

In considering this proposed type of chassis construction, I want you to bear in mind that it has been worked out and tested in actual service by two engineers other than myself. Both of these engineers are men of recognized standing and ability in the automobile industry and it is their experience quite as much as my own which makes me feel confident that I am presenting material for a substantial advance in the science of motor car construction.

If you will, in imagination, open the door of a representative car of today and cut through one side of that car, you will at once realize that about half of the material cut through has no structural value whatsoever. If, for example, the material used in a modern long span bridge, were as unscientifically arranged, that structure could not support itself.

Fig. 1, page 804, shows such a section of a car, and with it a similar section with the materials arranged so that while the appearance is substantially identical, practically every bit of the material used is of structural value. The section on the right, of a conventional car structure, represents what I believe to be about the best that can be accomplished along the old conventional line, and is therefore, in my judgment, beyond criticism as a work-out where the engineer has been confined to the type of construction used. If what I have to say sounds like criticism, I trust you will bear in mind that I am only endeavoring to compare types of construction and not to find fault with the work of any engineer, or the product of any organization. It is merely desired to bring out certain well-defined points by comparison.



Finished car mounted on a Brush chassis showing little difference from ordinary design

Weaknesses in Car Design

My purpose is to try to convince you that if engineers and producing organizations will free themselves from their habit of thought in chassis construction and consider this problem with an open mind, they will realize that their own interests and the interests of the ultimate consumer can, and will, be better served by this new and more scientific use of the materials which enter into the car structure. Let me briefly point out what I believe to be some of the weaknesses that are inherent in the conventional structure.

Many of you are familiar with the destructive effect of carrying touring equipment upon the running board; a practice by no means uncommon on long trips. Can you imagine a more improper way to load a U-section, pressed steel member than by the strains transmitted through the running board hangers. A 200-pound passenger standing upon the outer edge of the running board over one of these hangers applies locally approximately 3,400 inch-pounds of bending stress upon the vertical web of the frame, and a considerable amount of yield is inevitable. If anything like the equivalent weight is strapped to the running board, these strains are repeated and intensified indefinitely over a rough road, and the integrity of the whole structure is necessarily threatened. The only answer is either ultimate disintegration in the hands of the user, or, because of the incorrect application of stresses, a needlessly heavy structure.

Now, comparing this same problem in stresses with the alternative construction shown, it is at once apparent that load at any point on the running board results in downward stress well distributed upon the vertical web of the frame. The torsion effect, as will be shown in the other layouts, is applied to the frame only at the ends of the running board where proper and adequate provision for withstanding them can readily be made.

In these two sections, the cross sectional areas of the pressed steel frame members have been kept equal, but the application of the pressed steel running board eliminates the need of any considerable amount of lower flange throughout the length of the running board. This enables us to secure a deeper vertical frame web, which, in itself, guarantees greater rigidity for the same amount of material used, and this difference in vertical strength is further increased by the reinforcement which the running board itself forms, so it is obvious that the simpler, and as a whole, lighter alternative section is very much stronger than the heavier and more complicated conventional section.

Absolute Rigidity Impossible

We all know that absolute rigidity under varying strains cannot be secured by any structure. Considering for a moment the heavier, weaker and more complicated conventional structure, some interesting and obvious defects are

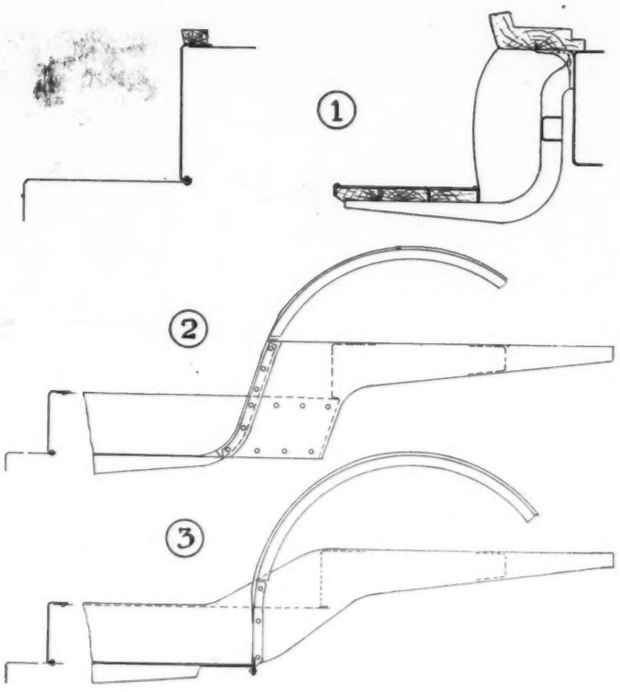


Fig. 1—Section of the conventional car and a similar section with the materials arranged to be of structural value

Fig. 2—Rear end of the running board may be used to form a bracket to avoid twisting strains on the frame

Fig. 3—Showing the possibility of using a single piece side member

apparent. The frame is bound to deflect appreciably under driving conditions. The running board apron, not being subjected to any of the road stresses, and having, because of its form, considerable vertical rigidity, is bound to move slightly with respect to the parts with which it is associated, and sooner or later, squeaks and rattles begin to make their appearance. The same thing is true of the body frame.

Again: Considering the proposed alternative structure, it is apparent that practically every bit of the material used helps to resist these fluctuating road stresses and the rigid association of the parts, together with the greatly increased strength has proved itself in actual service singularly free from this aging action which is so inherent in the conventional structure. By forming the chassis frame so that its vertical web is directly under the outer edge of the body, and because of the great increase in rigidity which is secured, there is no longer any need for the body frame or sill, and the light weight sectional body becomes a proper and advantageous structure.

I do not mean to say that the one-piece body cannot be used, but that it ceases to be a necessary or advantageous form of construction for the open touring car.

While for purposes of comparison I have shown a frame section identical in area with that found necessary with the conventional construction, a frame section less than .1 inch in thickness has been used in connection with a wheelbase of approximately 135 inches. On this test car the sectional body construction was used. The door fit was exceptionally close, and yet, after severe tests over the rough going of Arizona, not the slightest change in the fit of the doors could be detected. During this test, an unusually heavy touring equipment was carried on the running board. No supplemental running board supports were added, and yet no suggestion of body or frame squeaks or rattles was developed.

Fig. 2 shows how the rear end of the running board may be used to form a bracket to hold the running board in plane without local twisting strain upon the frame. It also forms a very rigid and conveniently located support for the rear tonneau door pillar. The rear fender is simplified; the rear seat heel board becomes naturally a valuable structural element of the chassis construction, and the tonneau itself becomes only a side and rear wall for carrying upholstering, the rear seat cushion practically resting upon the frame itself.

You will notice that just as wide a range of location of the rear seat and heel board is secured with this construction as with the conventional construction, but with the advantage that the rear heel board becomes a structurally useful instead of a structurally useless part. I presume the practice of making a two-piece side member will be questioned by some of you, but as I will presently show you, this is not a necessary phase of this type of construction, still I can assure you that it has no structural weakness, and because of the more economical use of the frame stock and the simpler body fitting, this detail of construction probably makes for some cost reduction. Fig. 2 approximates the dimensions used on a 118-inch wheelbase, five-passenger car, the frame material used being 12 gauge.

Fig. 3 illustrates the possibility of using the more conventional single piece side member, and the more conventional square corner between the rear end of the running board and the rear fender. The body fitting in this construction would not be quite so simple as with the two-piece frame, and the support for the rear tonneau door pillar, while undoubtedly ample, would not be quite so simple or quite so rigid as with the other construction.

Construction Has Adaptability

The following illustrations have been drawn for the purpose of illustrating the adaptability of this type of construction to a few of the various rear spring suspensions now in use. Figs. 4 and 5 show a form of rear spring suspension, which, while somewhat unusual, has a number of pronounced advantages, and in practice has given exceptional results. Fig. 5 is a rear view and I will use it to call your attention to peculiar advantages of this type of suspension. This is, as you see, a semi-elliptic suspension where the springs act in series instead of in multiple, that is, each spring deflects only half of the total spring action. A wide loading both on the axle and on the frame is secured, and the entire mass of the springs themselves is spring borne by the lower spring.

Shackling only one end of the spring, the ride is vertical, the same as when longitudinal springs are used, and unlike the single cross spring, there is no possibility of shackle sway of the vehicle.

Fig. 6 shows the conventional semi-elliptic spring suspension and you will notice that because in this frame construction the frame side members are kept as wide as will give proper clearance inside of tires, and because the lower flange of the frame has been substantially eliminated, the spring may lie entirely within the vertical section of the frame, the front end of the spring being bracketed advantageously into the angle formed by the top flange and vertical section of the frame. I hardly think the conventional semi-elliptic spring suspension in connection with this chassis construction needs further comment.

Fig. 7 will aid in considering the problems of cantilever suspension. This spring suspension, while favored by many engineers, taxes the rigidity of the frame more than any other, and for this reason I believe this extraordinarily rigid construction will be found to have exceptional advantages where this type of spring suspension is desired. The wide frame and the narrow lower flange permitting the spring to lie inside of the vertical web of the frame and close to that web, brackets being reinforced by the upper flange of the frame immediately over them.

This vertical flange, as you have no doubt realized, not only has exceptional strength because of its unusual depth, but is rigidly supported against torsional displacement by the running board, by the use of the rear seat heel board as a cross member, by its wide upper flange and by the tieing of

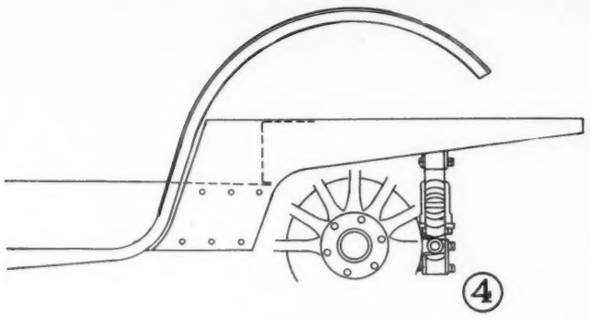
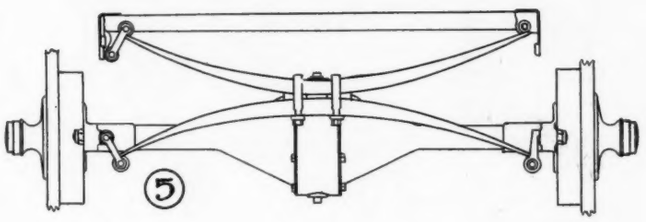


Fig. 4—Left—Form of rear spring suspension claimed to have advantages. Fig. 5—Right—Rear view of same suspension



the two upper flanges together, either by the use of a steel tonneau floor or by the use of the supports at the front and back of a wood floor.

Running Board Problem Double-Ended

I have not shown or discussed the support of the front end of the running board since this is obviously like the problem of the rear end. The front end of the running board may either be upturned to form its own bracket or a supplemental triangular bracket may be used immediately under the front fender. This front end support for the running board is naturally adjacent to the rear engine support which takes strains due to running board load off the vertical web of the side members. In cars using this type of chassis construction, it has been the practice to increase the width of the bottom flange of the frame members at the front end to conventional dimensions, letting this wider lower flange extend back to a point past the front end of the running board.

A type of construction, like a producing organization, is relatively efficient or inefficient, depending upon the amount of service rendered by each bit of material used. With this fact in your minds, I want you to let me turn again to Fig. 1. I trust you will all agree with me that what I have brought to you for consideration is a method of securing more service from every bit of material used in those elements of chassis construction which we have been considering. This arrangement of material has, in the hands of each of three engineers, shown decisive superiority in cost, weight and strength over their best handling of the conventional arrangement of material, and I am confident that in the hands of still other engineers, it will continue to show itself superior to the conventional type of structure.

It has occurred or will occur to some of you, that there is room for further development and refinement along this line. I should be surprised if this were not true, for this construction has, since its inception, received perhaps a total of four or five years of engineering consideration. The conventional structure has, without doubt, received within the last 10 years 10 centuries of engineering thought and study.

I have not tried to even approximately cover the field of discussion suggested by my topic. Front and rear axle construction and the arrangement and construction of the various other chassis units are still fertile ground for the exercise of engineering ability. I have confined myself to those phases of what I believe to be more scientific chassis construction, which seem to me to need the most drastic treatment and promise most decisive improvement in the car as a whole.

The discussion brought no weaknesses to light. Pictures of a car actually built and in successful operation with this form of construction were conclusive evidence that Mr. Brush knew what he was talking about.

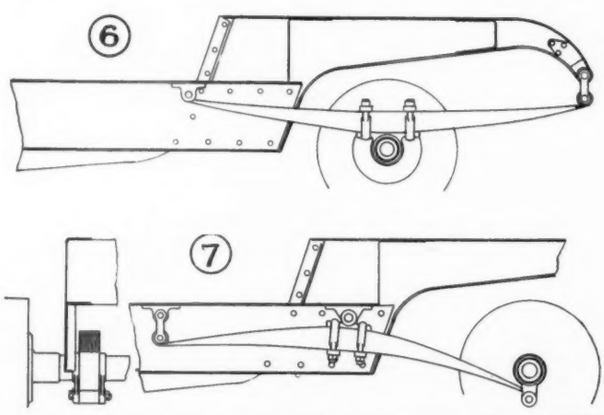


Fig. 6—Conventional semi-elliptic spring suspension, showing wide frame side members

Fig. 7—Extraordinarily rigid frame structure necessary with cantilever rear springs

Discussion Revealed No Weaknesses

J. G. Vincent, Packard engineer, questioned Mr. Brush as to the difficulty of narrowing the wider chassis at the front end so as to give a small turning radius. It was explained that the construction followed the bottle-neck form, and that it narrowed just as any other frame does, giving average clearance for front wheel turning. G. W. Dunham, consulting engineer, thought that the greater width at the rear might affect the wheel house and clearance, but it was stated that though the frame is wider, there is ample clearance, even with a 5-inch tire.

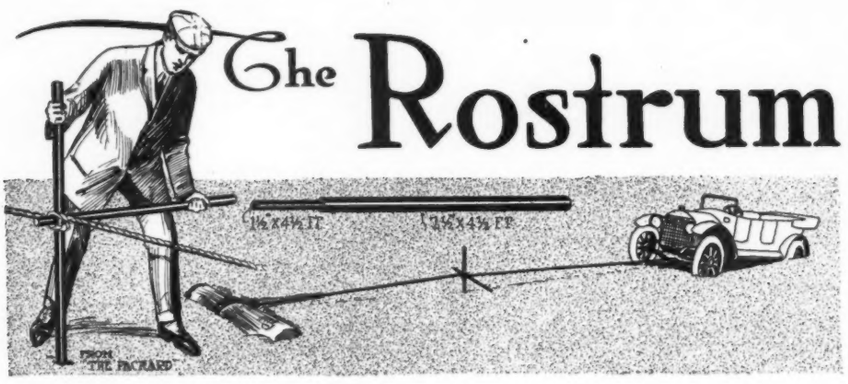
Russel Huff, consulting engineer of Packard company, claimed that the running boards depend upon the fenders for their support, but Mr. Brush explained that the fenders do not act in this capacity at all, since the running boards are riveted to the lower web of the frame throughout their length, and then at the ends are bent upward and again attached to the frame. It was explained also that, whereas the conventional running board bracket acts as a lever to exert considerable bending force on the upper part of the frame, the new construction cannot put any bending stress on the frame, but only a vertical downward stress distributed along the vertical web.

The matter of finish was questioned by C. C. Hinckley, Chalmer's engineer, who also asked as to the section over the front springs, and whether or not it would allow for plenty of spring action. As to finish, it was held that proper care in applying enamel would take care of it, whereas, it would be easy enough to apply a linoleum covering to the running board metal. As regards the section at front, this was explained to be brought down in depth to about the same amount as any conventional frame, allowing similar spring radius.

A comment was made that damage to fender and running board might affect the frame, making a repair difficult. To this Mr. Brush replied they were bringing up the same objection as has often been heard in the past on the block cylinder casting. If you damage one cylinder, all have to be replaced.

L. C. Weinberg gave a lecture on the development of vacuum or suction in fuel feeding systems. Using the blackboard, he sketched the elements of a number of different patents, and showed how different men had attacked the subject from different points of view. He stated his opinion to be that good as was the vacuum feed today it still was not in a final stage of development, and he expected to see great improvement take place within the next few years. The principal fault of the systems in use is said to be the liability for the feed tank to run dry if the motor is run at high speed with wide open throttle for a long time, this being more noticeable on some motors than on others since it depends upon the depression at which the carbureter will operate. The author was sure this could be overcome and sketched some methods for reaserch which might be followed. In dealing with his own experiments he indicated the detail troubles which could be encountered with apparently perfect systems, and laid emphasis on the fact that the suction feed was so good that it would of a certainty be developed into something still better, neater and yet more efficient.

The Rostrum



Spanish Windlass

¶ *A simple device for the extraction of an automobile from deep sand or mud is illustrated herewith. A large tree or railroad tie sunk in the earth or some other solid, immovable object is used as a base of operation. To this is tied a rope and at the other end the rope is fastened to the car. About half way between the immovable object and the car, a 4.5-foot wrought iron pipe is sunk vertically into the ground. A connection is made around another pipe of the same length as shown in the illustration herewith and, by means of the long fulcrum thus produced, is used in winding the rope around the drum formed by the pipe which is sunk into the ground. For convenience in carrying, the two pipes may be telescoped together as illustrated.*

Formula for Two-Cycle Horsepower

EDITOR THE AUTOMOBILE:—What formula would you recommend for calculating the actual horsepower of a two-cycle, three-port engine?

2—What formula would you recommend for calculating the actual horsepower of a two-cycle engine having differential pistons?

As I understand it, a two-cycle engine having differential pistons will develop about twice the horsepower that a four-cycle engine of the same cylinder size will.

Rutherford, N. J. WM. C. DAVIDS.

—A formula often advanced for a two-cycle engine is the following:

$$P_b = \frac{d^2 pln}{600{,}000}$$

In this d is the diameter of the cylinder in inches; l, the length of the stroke in inches; n the revolutions per minute; p, the mean effective pressure and P_b, the brake horsepower.

For a two-cycle three-port engine it would be safe to assume the mean effective pressure as 60 pounds to the square inch. This would give you then for brake horsepower the following formula:

$$P_b = \frac{d^2\ ln}{10{,}000}$$

For N cylinders the final result would be N P_b.

2—It will be quite safe to use the formula $\frac{d^2 n}{1.25}$ for two-cycle engine with differential pistons. In this formula d equals the diameter in inches and n the number of cylinders. The constant 1.25 includes the stroke in calculating the piston speed as 1,000 feet per minute and the mean effective pressure as 90 pounds to the square inch.

Reboring Ford Cylinders with Special Reamer

Editor THE AUTOMOBILE:—Would Ford cylinders rebored with a spiral fluted reamer and finished by lapping make a satisfactory job?

2—Which would you recommend, the rose shell or spiral fluted reamer, the rose shell to be spiral also?

3—What should be the size of reamer to fit Ford piston No. 3020-D, which is .03125 inch oversize?

4—What metal, other than platinum, that can be procured anywhere is best for repointing master vibrators? This, of course, means for a temporary repair to enable a car to reach a place where new parts for vibrator may be secured.

Briscoe, N. C. C. B. AUMAN.

—There is no reason why a spiral cutting reamer that would be adjustable would not work as well as the straight cutters. They would be hard to sharpen and adjust and more expensive to install.

2—This is answered under question 1.

3—The Ford company does not lap cylinders after reboring, but fit the oversized pistons, which in most cases are .001 inch or more oversize. The cylinders are bored .0025 inch larger than the piston. At a good many of the Ford company's branches the cylinder block will be rebored, rebabbitted and oversized pistons fitted for $3 and for this reason it would not be advisable for an agent to go to the expense of installing a boring machine and tools.

4—For a temporary repair German silver, silver or a piece of tungsten steel can be made to suffice.

Shunt Field Seems to Be Open

Editor THE AUTOMOBILE:—An Apple dynamo has been used for lighting on a Buick car with storage batteries. The dynamo does not deliver a current now and on taking it out for testing, I can find no fault in the wiring and the dynamo runs as well as a motor on current from dry cells at 9 volts and 30 amperes. Why does it not generate?

E. Brookfield, Mass. F. H. DRAKE.

—From the data you furnish it appears that the shunt field is open. To determine this, lift the brushes off the commutator and test to see if you get a current through the shunt field.

Oversize for Cyclecar Rims

Editor THE AUTOMOBILE:—Is it possible, and if so, would it be advisable to put a 3-inch automobile tire on a 2 1-2-inch rim? I have in mind a clincher tire. The wheels are cyclecar wheels 28 by 2 1-2 and I wish to use a 28 by 3-inch tire.

Plantersville, Miss. W. I. S.

—If you are using the latest type or CC rim you can put a 28 by 3-inch tire on the rim. If you have the old type rim you will not be able to do so but you can apply the regular oversize for the 28 by 2 1-2, which is the 29 by 2 3-4.

Cannot Find Maker of Eberman Pump

Editor THE AUTOMOBILE:—Can you inform me where the Eberman power tire pump is made?

I have a small one-cylinder affair and I do not know where I may send it for repairs.

2—I am also having a great deal of trouble with my Everett six in regard to grease working out of the rear axle upon wheels and brake drums, etc. I have had the

wheels taken off, axles repacked, and have also had the axles out, but with no result.

The felt packing seems to permit the grease to come through it or around it so that it gives me a great deal of trouble. How can I have same packed and what kind of packing can I use?

3—Can you tell me how I can plate my horn with nickel? I have same off and would possibly have all necessary articles if I knew the process, formula and what voltage current to use.

West Salem, O. R. C. WALLACE.

—THE AUTOMOBILE is unable to locate the makers of this tire pump but it is possible that one of our subscribers reading this will communicate with you giving you the desired information.

2—The best method would be to secure an oversized felt packing and probably use two felt washers in place of one, packing them slightly into the space between the axle shaft and housing. If this does not suffice a grease trap in the shape of a disk fixed to the shaft which will throw the oil by centrifugal force to the housing where it will drain back to the differential gearcase can be fitted. This should not be necessary, however.

3—The cheapest method for you to nickel-plate your horn would be to use a liquid preparation which will give the desired deposit of nickel on the horn. This can be secured from any large hardware concern. It would be cheaper and more satisfactory if you desire to electro-plate the horn to send it out, but if not you can nickel-plate it yourself by making up a nickel-plating bath and following the directions for nickel-plating which you can secure from any book on electro-metallurgy. The instructions are too lengthy to be given here on account of lack of space.

Location of North East Cut-Out

Editor THE AUTOMOBILE:—Kindly explain by sketch the location of the regulator on the North East motor generator?

N. Y. C. JOSEPH DALY.

—The location of the regulator on the North East motor generator is shown in the accompanying illustration, Fig. 1. As will be noted, the regulator is contained within the main housing.

Camphor Not a Carbon Remover

Editor THE AUTOMOBILE:—Will you kindly advise me whether there is any efficacy in using a small amount of gum camphor placed in each cylinder when the engine is hot to remove carbon, and if so, what the theory is and just how the camphor should be used?

2—Can you recommend anything to remove carbon from the cylinders? G. W. B.

Shelburne Falls, Mass.

—It would not be advisable to place a small amount of gum camphor in each cylinder when the engine is hot to remove carbon. When camphor burns carbon is released and gum camphor cannot be considered efficacious for removing carbon.

2—Carbon can be burned out with oxygen, scraped out or dissolved by some of the better carbon removers. There are some liquid removers on the market which have stood the test of time and which have many adherents.

Instruction in Horsepower Calculation

Editor THE AUTOMOBILE:—Can you tell me whether THE AUTOMOBILE intends to publish an article on how to calculate the horsepower by the bore and stroke? Also showing the difference between a magneto and a Genemotor?

Beaver Springs, Pa. W. C. BAKER.

—THE AUTOMOBILE has frequently published references to different formulas by means of which the different horsepowers can be calculated from the bore and stroke. The most frequently used of these is the S. A. E. formula $\frac{D^2N}{2.5}$ in which D is the bore of the motor in inches and N the number of cylinders. This formula will give you approximately the brake horsepower of the motor and is very simple. You need not include the stroke in the calculation as this is already included in the 2.5 figure as it assumes a piston speed of 1,000 feet per minute and this depends directly on the stroke.

Regarding your question on the difference between a magneto and a Genemotor, the Genemotor is the trade name for a given make of motor-generator. A magneto is a simple type of generator which provides electric current for ignition. As it supplies an alternating current this current cannot be stored in a storage battery and hence it is necessary in starting and lighting systems to provide a direct current generator. An electric motor is required to crank the gasoline engine. This in some cars is a separate device but in others is combined with the generator, the combination being known as a motor-generator. It will thus be seen that the difference between the magneto and the motor-generator is a wide one.

Gear Ratios of Eight American Cars

Editor THE AUTOMOBILE:—What are the gear ratios of the following touring cars: Hudson light six-40; Davis 38, model B; Buick, model C-25; Overland, model 80-T; Dodge Brothers touring car; Herff-Brooks, 4-40; Chandler six-35; Saxon six.

Carver, Minn. E. H.

—The gear ratios of the cars referred to are as follows: Hudson 6-40, 3 10-13 to 1; Davis 38, 4 to 1; Buick, model C, 4 to 1; Overland, model 80, 3.75 to 1; Dodge 3.615 to 1; Herff-Brooks, 4-40, 4 to 1 with an option of 3.5 to 1 if desired; Chandler 4.4 to 1; Saxon 4.6 to 1.

Horsepower Calculated by Formula

Editor THE AUTOMOBILE:—What is the horsepower according to the S. A. E. rating and brake power; size 3 3-4 by 5 1-4? Also size 3 3-4 by 4, number of cylinders four, for both?

2—How can I figure the horsepower with both bore and stroke of an engine? Give example for guide.

Beaver Springs, Pa. W. C. BAKER.

—The horsepower rating according to the S. A. E. formula for a four-cylinder 3.75-inch motor with a 5.25-inch stroke is 22.5. The S. A. E. rating for the 3.75 by 4-inch motor will be the same, since the only variable factor in the formula is the bore. It is impossible to give you the actual horsepower

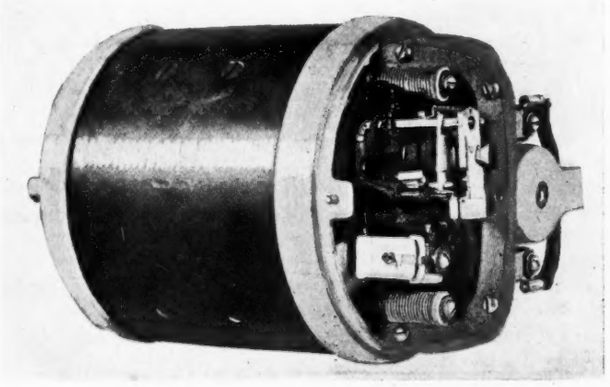


Fig. 1—North East generator with cover plate removed showing location of cutout

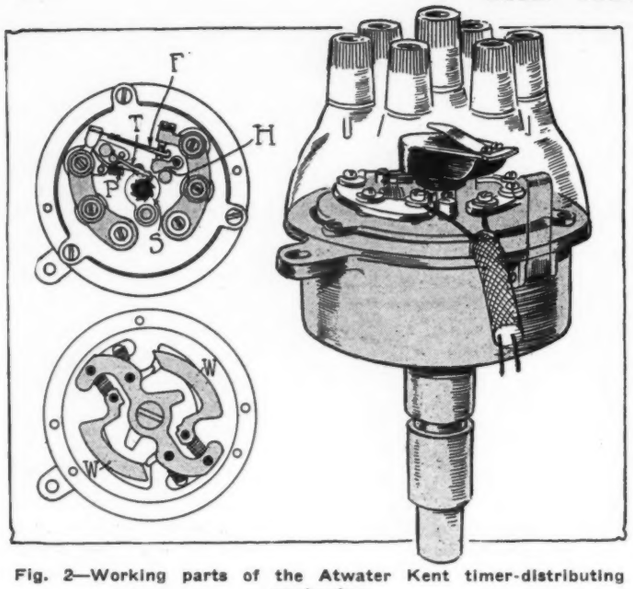


Fig. 2—Working parts of the Atwater Kent timer-distributing mechanism

without an actual dynamometer test of your motor but it will closely approach that given by the S. A. E. formula.

2—A formula which takes in both the bore and stroke of the motor is that of E. P. Roberts which is $\frac{D^2LRN}{18,000}$ equals horsepower.

In this formula D is the diameter of cylinders in inches, L the length of the stroke in inches, R the revolutions per minute of the crankshaft and N the number of cylinders. Thus, in a given example if the bore is 3 inches, the stroke 4 inches, the revolutions per minute 1000, and the number of cylinders 4, the horsepower according to this formula would be 8 horsepower.

E.M.F. Used Continental Demountable Rims

Editor THE AUTOMOBILE:—What type of Schebler, also what type of Stromberg, carbureter is best adapted for a 1912 E. M. F. model 30?

2—What make of demountable rim is used on the 1912 E. M. F. 30 and where can they be obtained and at what price?

3—What is the cause of gasoline running out of the bottom of a Rayfield carbureter on a 1913 Mitchell six, just as soon as the motor stops? The carbureter is set so that the car runs well.

4—What causes grease to come from the left side wheel end of the rear axle of a Ford car when it will not come out at the right side end, and how can it best be cured?

Hull, Iowa. H. J. H.

—The Schebler company recommends the use of the model L 1.25-inch size carbureter for this car. The Stromberg recommends the model K 1 inch.

2—The Continental demountable rim is used on the 1912 E. M. F. 30. These can be obtained from any of the Studebaker stock rooms or service stations at a cost of $3.40. The official part number of this in the Studebaker lists is A-4060. A few of these cars use the Gilbert rim, which is no longer obtainable.

3—The probable cause of the gasoline running is that the heavy fuel which is in the manifold condenses after the car has stopped running and will run back into the carbureter and drip out. By putting a full hot air attachment on the motor so that all the air is heated by passing through a muff surrounding the exhaust manifold, the dripping will probably be stopped. It is not a serious trouble, however, and if your motor runs well, the change would not do other than perhaps give you a slightly greater fuel economy.

4—The packing on the left side of the axle has evidently become worn out and this can be cured by securing felt washers for this purpose from the Ford company.

Battery Ignition vs. High-Tension Magneto

Editor THE AUTOMOBILE:—Which is the best ignition for a car? High-tension magneto or storage battery, and which is most complicated and most expensive? Which will give the least trouble? I have had experience with magneto ignition only.

2—Please explain the Atwater Kent ignition and if possible give an illustration.

3—Is the speedometer on the Grant-six geared from transmission or front wheel?

4—Is it harder to detect motor trouble in a six than in a four?

5—Has any of the three companies, Saxon, Grant or Metz sold out? Do they wish to do so?

Shippee, Neb. IRA MCCOMB.

—If the figures on American practice be taken into consideration, the adherents of both magneto and battery ignition would find plenty of ground upon which to base their arguments. Important concerns use both and hence it is impossible to say that one is better than the other because if this were the case a great majority would be using that type. An article entitled Magneto vs. Battery Coil appeared in THE AUTOMOBILE for January 7, page 20.

2—Atwater Kent ignition system is illustrated in Fig. 2 as regards the timing distributer mechanism, which is the heart of the entire system. Primarily, the Atwater Kent system comprises a coil and a combined breaker and distributer mechanism with a switch for the control of these units. It is in the circuit breaker that the design is distinctive, the great feature being that it is impossible for the two points of the breaker mechanism to remain in contact while the switch is on and the motor is not running. Referring to the illustration, the shaft S, which is the rotating portion of the breaker distributer mechanism, has four, six or eight notches equally spaced peripherally according to the number of cylinders. The trigger T catches in these notches and is drawn around with the shaft a minute distance. When it escapes from the notch it rides slightly up on the round surface of the shaft and then returns to its normal position by the tension in the coil spring P. As the trigger T jumps back under the influence of the coil spring, it strikes the hammer H, which in turn transmits the blow to the flat spring F, bringing the contact points together for a very small period of time. This gives the contact and breaks it in such a short space of time that the eye cannot follow the opening and closing of the points.

3—The speedometer of the Grant car is geared from the front wheel.

4—It is not harder to detect motor trouble in a six than in a four for one who is accustomed to both motors. The difference in complication is very slight.

5—The three companies which you mention are in excellent condition and are selling their outputs without trouble.

Why Dry Disk Clutch Drags

Editor THE AUTOMOBILE:—We have a dry disk clutch which is giving us trouble. It will grab and will not slide.

2—Where is the best place to look for a knock?

3—Would it be possible for a young man about 17 years of age to have a state license as a driver, if he has had 2 years experience as a driver and repairman?

Logansport, Ind. A READER.

—The place to look for trouble on a dry disk clutch is in the facing. There is probably some roughness or some sticki-

ness in the surface which gives rise to the grabbing. There is another possibility in that the trouble is that the spring is adjusted too tightly which does not permit of an easy engagement.

2—All moving joints are susceptible to knocks. Tracing through the transmission of power from the cylinder to the rear axle, we find that at each point of engagement one or more moving parts with other parts there is a chance for a knock. Starting with the piston, if this is too loose, there will be a distinct slapping sound. It can only be cured by the use of an oversized piston. The next point is at the wrist-pin which might have a knock due to looseness in the upper connecting-rod bearing. The third point is at the lower bearing of the connecting-rod. The fourth point is in the main bearings in the crankshaft. Fifth, at the connection between the crankshaft and clutch then in the universal joints and the gearbox bearings and between the teeth of the different gears. Loose valve tappets, timing gears, Oldham couplings, etc., are also fruitful sources of knocks.

3—Consult Indiana state motor vehicle law.

Changing Direction of Magneto Rotation

Editor THE AUTOMOBILE:—Please publish in THE AUTOMOBILE whether or not a Bosch high-tension magneto can be run in both directions by changing the gears, as they are marked to run both ways, and if they will throw as strong a spark one way as they will the other?

Loudonville, O. F. A. Y.

—The Bosch magneto cannot be run in both directions, but must be run in its designed direction. The magneto, however, can be changed over at a cost of about $2 at any one of the Bosch service stations. The work requires the substitution of another breaker box mechanism for that on the magneto. The charge will be increased if it is found that the mechanism already on the magneto is in poor condition, as the cost of repairs on the old one is charged against the amount allowed for the used mechanism.

The design of the keyway on the breaker shaft is such that it cannot be used for a magneto which will run in either direction and consequently in ordering a Bosch magneto it is always necessary to specify whether the instrument should run clockwise or anti-clockwise when looking at the instrument from the shaft end. The direction in which the magneto rotates will have an influence on the system of wiring and upon this and the order of firing in the cylinders will depend the method or system by which the wires from the distributer are attached to the spark plugs. Referring to the accompanying illustration, Figs. 3 and 4, the wiring scheme for clockwise and counter-clockwise magnetos will be seen.

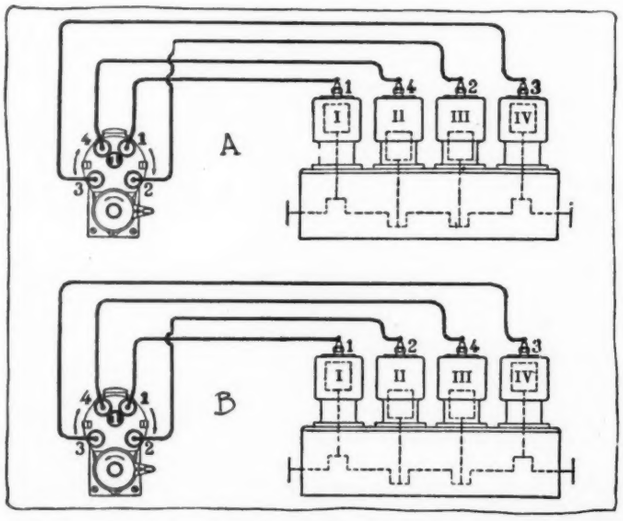


Fig. 3—Diagrams of connections with a magneto which runs clockwise

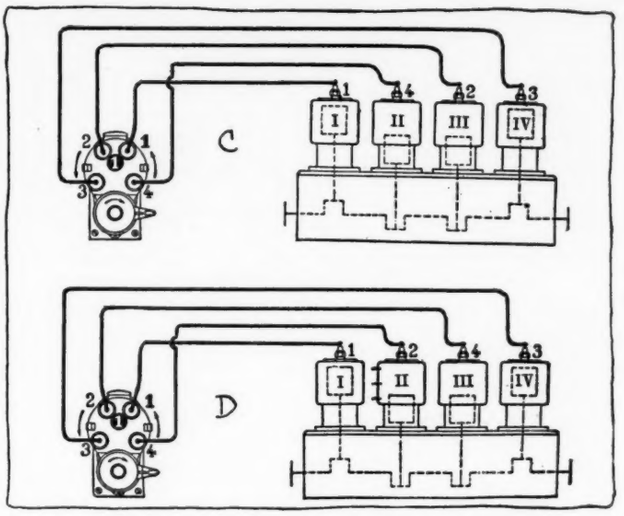


Fig. 4—Connections shown by diagram for a magneto which runs anti-clockwise

Special Franklin Holds Economy Record

Editor THE AUTOMOBILE:—Kindly let me know through the Rostrum what the world's economy record per mile is for automobiles, including steamers, and also by whom this record was made, where and when.

Greenwich, Conn. E. C.

—The record for fuel economy is held by a specially-constructed Franklin car which on June 21, 1913, ran a distance of 83.5 miles over Long Island roads on 1 gallon of gasoline. This car was a special car in every way and cannot in any way be understood as a stock design. The body was a sheet aluminum design in the form of a two-seated roadster with torpedo lines. The weight of the empty car was 1,695 pounds and its total weight with driver and passenger at time of the test was 1,995 pounds. The driver was S. G. Averill, the owner of the car, who was accompanied by an official of the Automobile Club of America, who acted as official observer.

Lightness Big Factor

Everything on this car was done to reduce the coasting resistance. The rear axle was placed on ball bearings and the drive was taken through only one real wheel, the other running free. Plain clincher tires were fitted, 34 by 3.5 inch in size and inflated to a pressure of 35 pounds. The country passed through on the test was fairly level, with an occasional 2 or 3 per cent. grade. The test lasted 6 hours and the average speed over the entire distance was 14.5 miles per hour or about average touring speed. The driver would open his throttle until he had attained a speed of close to 20 miles per hour and then would stop the motor and coast until the car had almost stopped.

Distances per gallon of gasoline traveled by different vehicles vary greatly. A motorcycle has traveled 190 miles on 1 gallon and 10 ounces. This was done by S. A. Baker in 1907. The average accomplishments of stock models equipped with regular bodies fall far below this record. The average gasoline automobile travels from 15 to 25 miles on a gallon, although some touring cars go as low as 4 miles to a gallon and others as far as 30. The average steam automobile goes 10 miles to the gallon, and the average aeroplane 10 miles to the gallon with its fuel mixed with lubricating oil.

Discussion of "The Improvement of Spring Systems"

Springing to Relieve Driver's Fatigue on Rough Roads

Tire Qualities Demanded If Air Tires Were Discarded—Steering and Skidding Considered

TWO contributions on the subject of horizontal springing for ordinary automobiles are presented in the following and indicate the wide interest which would be taken in any adequate constructive solution of the problem. The first one, from an engineer who does a good deal of rough country driving, calls attention to the important question of driver's fatigue and mental tension, to which traffic accidents are often indirectly due, and incidentally suggests the remark that nearly all the main viewpoints emphasized in the M. C. K. articles relate chiefly to driving under worse than normal road conditions or driving at speeds which make even the normal road conditions trying; also that the requirements for commercial vehicles have been kept fully as much in mind as those of the pleasure vehicles, in most of which the loads vary only between narrow limits and for which, therefore, springs in combination with air tires can be made to answer the principal purposes fairly well.

An Engineer's Driving Experience

Editor THE AUTOMOBILE:

In connection with the series of articles you are publishing on the subject of Spring Systems, I note the comment by W. M. E. in your issue of April 1, as to the effect that might be produced by introducing springs to take up horizontal as well as vertical shocks and the effect on roadability of the resulting horizontal movements of the axles.

It occurs to me that this horizontal movement would have another important effect on the steering. On a perfectly smooth road almost any kind of a steering gear is good enough but on a rough road the reaction of the front wheels about their steering spindles would make steering very troublesome unless a self-locking or "irreversible" form of steering gear is used. This is of course the chief reason for the general use of worm steering gears and eighteen inch steering wheels notched or ridged to make them less liable to be jerked out of the hands by a hard shock. Anyone who has ever run over a dog or struck any large obstruction at fair speed with one front wheel only, will realize why irreversible steering gears and large notched wheels are necessary. Of course the vertical effect or component of a blow or shock received on the wheel does not affect the steering or tend to turn the front wheel but the horizontal component does.

Calculations made in these articles show, in actual figures just why and how much these horizontal components are, for instance the case mentioned in THE AUTOMOBILE of Dec. 31, 1914, of a 3,000-pound car under stated conditions, where the horizontal component of a jolt was figured to be 8,524 foot-pounds with a forty inch wheel. For a 34 inch wheel which is more common for a car of that weight, this horizontal component would become 9,200 foot-pounds. This is for both front wheels striking equally and at same time, in which case there is little effect on the steering as the turning effect on the two wheels is opposed in direction so that the jerk is taken up in the tie rod. If however only one front wheel strikes the obstruction, only part of the weight of the front end of the car is raised, though the kinetic energy of the entire car helps to force it over the obstruction. In this case the horizontal component will be something less than 9,200 foot-pounds, but with an obstacle larger than three inches the horizontal shock on one front wheel might easily be as much or even more than this figure.

Such a shock on only one front wheel will give a very large turning effect to the front wheel, and without any counteracting effect from the other wheel through the tie rod, the steering gear itself has to stand this great shock, and in spite of the so-called irreversible gear, the steering wheel will get a vigorous jerk, and that is where the large size wheel with the notches comes in.

And it is not only when the wheel is being held that the shocks have a bad effect on the ease of steering, but also when the wheel is being turned. Should the driver try to turn the wheel at just the instant when one of these great shocks is being transmitted to the steering gear, the movement would be retarded for at least the length of time that the shock is in effect, and it might even happen that the wheel would be jerked slightly backward.

Cushioning these heavy shocks on the steering gear by permitting horizontal movement of the axle would certainly reduce greatly these jerks on the steering wheel, make it easier to turn the wheel during the time in which a shock is being received, and, in general, steering over rough roads would be much less of a trial than it is under present conditions. On a long drive it is not the simple turning of the wheel to keep the car in the right direction, that becomes so tiresome, but the constant tension and readiness for instant action, for readjustment of the wheel after each severe shock and bracing up for the next shock.

So it seems if these shocks to the steering wheel which come only from the horizontal effect of road shocks, can be eliminated or reduced by horizontal springing, a very large part of the strain of driving, at least country driving, would be removed. I do not know just how this will all work out in practice, but on paper it looks as if it should be one of the important benefits of horizontal springing.

New York, April 23, 1915. C. A. D.

It might be added that springing always taking effect in the direction of the shock, if this be possible to encompass, should afford the same relief.

With reference to the opening words of the following letter, M. C. K. would like to say—to obviate all misunderstanding—that in his opinion pneumatic tires, far from being a curse or even a necessary evil, have so far been a blessing for the automobile industry and its patrons, easing construction work immensely, and one not to be lightly discarded. So far as pleasure automobiles are concerned, he sees the advantages from the perfecting of horizontal springing rather in a better chance for saving wear and deterioration of the air tires, through reduction of the worst shocks and the practicability of keeping them fully inflated and otherwise protected, than in any change to tires of a different type and material. Rightly read, he thinks, the letter by O. W. H. stands for the same view for the present time, the difference being in terms of expression only.

Substitutes for Pneumatic Tires

Editor THE AUTOMOBILE:

I have been very much interested in the recent articles in your publication on Spring Systems, especially those in which there are given indications that a system of horizontal springing may be used as a substitute for pneumatic tires. It seems to me that the opportunity to do away with the curse of pneumatic tires is one of the greatest things that could happen to the automobile industry.

If it is true, at speeds exceeding 35 miles per hour, that obstacles three inches or more in height produce horizontal shocks which are of greater magnitude and which cause more damage than the vertical shocks resulting from the same obstacle, it is obvious that cushioning these shocks is of primary importance. However, would not the possibility of

using solid tires be of more value than the saving of the car from these shocks? From the viewpoint of the manufacturer the most important detail is to build a car which will withstand rough usage for the greatest length of time, but from the standpoint of the user, I believe that the tire question is of more interest.

I believe that it should not be a difficult matter to construct a car in which the axles would move horizontally a distance equivalent to the horizontal component of the "give" of the pneumatic tire under identical conditions.

In Fig. 15 of the issue of February 18 the tire gives to a point *a*, which is approximately half of its thickness; the horizontal component is about two-thirds of the entire radial movement. In the case of a 3 inch tire this would be equivalent to a radial movement of 1 1-2 inch and a horizontal movement of about 1 inch. It is doubtful if tires which were properly inflated could give to this extent, except in unusual circumstances, and the life of the tire would be greatly cut down. It should not be difficult to design a system of horizontal springing which would require the same force to push the axle back 1 inch as to dent the tire an equivalent distance. In that case, as far as the horizontal shocks are concerned, the results should approximate those with pneumatic tires.

If this is ever accomplished, and solid rubber tires come into extensive use on pleasure cars, I believe that it will become necessary to develop some special type of solid rubber tire.

With a system of horizontal springing a soft tire should not be necessary for comfort, although it would be necessary to have a tire that would flatten out sufficiently to obtain good traction and safe steering. No explanation is necessary as far as traction is concerned, but it may be well to say a few words as to the steering part as related to the contact area.

At speeds over 25 to 30 miles per hour it is a difficult matter to steer a car equipped with solid rubber tires. This is because of the fact that they act so quickly that small bumps keep them off the ground a greater portion of the time than in the case where pneumatics are used. Then, when they come down, the time of contact is so short that they often fail to follow a change in steering. This partly explains the matter, but there is a further factor which enters into the matter.

The pneumatic tire, in flattening out, leaves on the ground a long elliptical contact surface, the long axis of which is in the plane of the wheel. On the other hand, the solid rubber

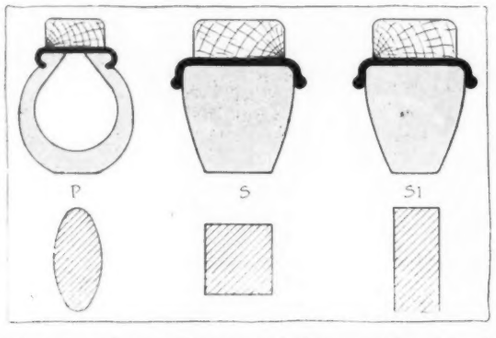


Illustration of road contact areas and shapes produced by different types of tires: S1 being the proposed special not yet materialized

tire flattens out little and leaves a contact surface that is nearly square. The elliptical contact of the pneumatic tire is so long that the wheel tends to follow any change in its direction almost immediately. The square contact of the solid rubber tire is so short along the plane of the wheel that the wheel responds to a change in direction much more slowly.

On curves where the side thrust is great, the tendency to skid in the case of the solid rubber tire is greater than with the pneumatic tire. This is due to the smaller area in contact with the ground, and also to the fact that the solid tire is on the ground a smaller portion of the time.

If we had a solid rubber tire with a rectangular contact area instead of a square contact of the same area, and if this rectangular area were very long in the plane of the wheel, then this tire would respond to changes in the course very readily—nearly as well as a pneumatic tire. On curves, however, due to smaller contact area, the skidding would be as bad as with a "square" tire. It is the length of the contact on the ground that governs the quick response to steering changes.

Therefore, we may see that, even though a soft tire is not necessary for comfort when a system of horizontal springing is used, something better than the present solid tires is necessary for safety at high speeds.

Some years ago I read an article concerning the use of a cork filler for tires, and have since wondered why it was that this did not come out on the market. The other tire fillers all have their drawbacks; some of them are affected by heat and others by cold; most of them take a permanent set when left standing for any length of time, and they are all entirely too heavy. It seems to me that ground cork, impregnated with rubber and pressed in a form until all superfluous rubber has been squeezed out, should make a light and resilient filler, not affected by temperature changes. It should not flatten out appreciably or take a permanent set if left with the weight on it for a length of time. Such a tire would flatten out on the road with a sufficiently long contact for good steering, and would yet stay down over bumps better than a solid rubber tire.

It may be, however, that there is some very good reason why such an apparently perfect filler is impracticable. With an air-filled tire, struck at a point *a* by an obstacle, the most damage on the exterior is sustained by the tire at *a*, and within it the change in pressure is distributed uniformly over the entire surface. That is, the whole tire withstands the increase in pressure due to the shock. With a filler, however, there is no tendency to distribute the shock to all parts of the tire internally. Therefore, not only must the tire at the point *a* stand the external shock, but the region surrounding *a* must withstand the bulging due to the compression of the filler at the point struck. It may be that this is the reason for the poor success of all fillers, thus far, and possibly the same would be the case even with the cork filler.

It might be possible, however, to make this composition of rubber and cork into a solid tire, eliminating entirely all points of similarity to a pneumatic tire, and dispensing with the shoe. Its lightness would allow its use in about the same sizes now used in pneumatics without an excessive increase in weight, and this large size would allow the filled tire to approach the pneumatic tire in results.

Some such tire, combined with horizontal springing to take up the horizontal shock ordinarily taken by the pneumatic tire, would prove to be the greatest possible boon to the automobile public.

April 24, 1915. O. W. H.

It would be interesting to hear from others who have an extensive driving experience on some of the points raised by O. W. H., notably as to whether skidding is really more likely to occur when the contact area is small, without regard to its shape, and whether a pneumatic tire really remains more steadily in contact with the road than a solid tire if it is strongly inflated. The prevailing opinion seems to be that the pneumatic tire has this particular advantage mainly at high speed—which of course is very important—but otherwise only if its flexibility is markedly superior to the flexibility of the vehicle springs. It may be a question if a solid tire made of a material whose resilient reaction were as slow as that of a cushion stuffed with horsehair—a material not yet invented so far as tires are concerned—would not have similar advantages at all speeds, with regard to the steering and the skidding.

The possibilities in this connection are as yet unexplored. It seems to have been taken for granted that, inasmuch as the prompt resiliency of pneumatic tires APPEARS to be a desirable feature, an equally prompt resiliency must be an advantage in solid tires, though necessarily of smaller range. In reality, as the same spot of the tire does not strike again till, say, 120 inches farther on in the road, a very much retarded resiliency might serve better. There seems to be a field for experiment and invention on this line of thought for ALL TYPES of TIRES.—M. C. K.

The Engineering Digest

Movement for the Wider Manufacture of Small Motor Ploughs

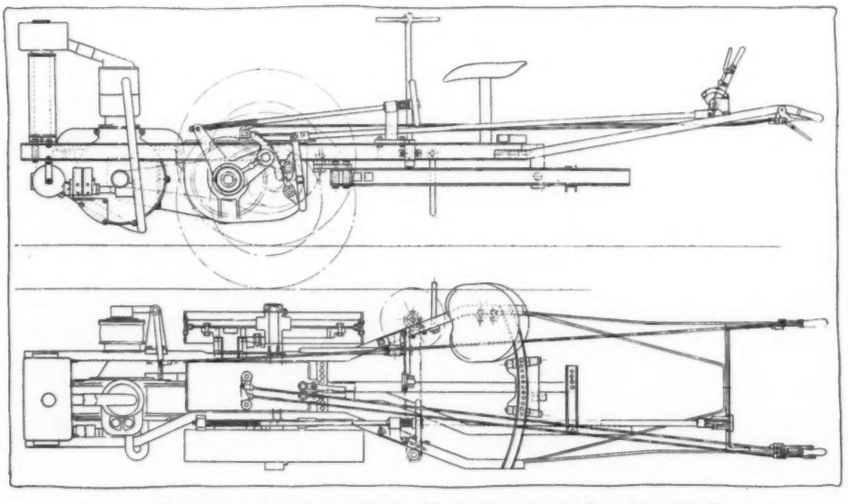
EUROPEAN MARKET TO FACILITATE DEVELOPMENTS

WITH several millions of men and horses removed from the ranks of workers, the European nations will after the war experience a very urgent need of motor ploughs and other agricultural motor machinery, and they will draw as heavily as possible on American supplies in these lines, even to the extent of placing their farm mortgages largely in the hands of American investors. As the demand for self-propelling machinery up to July 1914 was limited only by the shortcomings in construction which made it suitable and profitable only for very large estates, and favorable soil and surface conditions, the attention of designers has been turned strongly to the small working unit, and a large number of motor ploughs supposed to meet the requirements of the farmer of moderate means have made their appearance, but with regard to none of them have decisively favorable results in practice been recorded. No firmly organized co-operation of constructive and agricultural insight seems to have been effected anywhere to solve the knotty mechanical and economical problems involved, each designer apparently fancying that he can strike a happy solution alone with a few picked-up bits of information with regard to the many different things which the average farmer must be able to do with the machinery in order to make it pay, while the farmers usually imagine that they ought to be enabled to farm with machinery on just the same plan which they have always followed.

The tendency toward the small unit is illustrated in the new Wyles plough shown in the accompanying cut. It is propelled by a single-cylinder gasoline motor of 8 1-2 hp. with a two-speed gearbox. The drive is by chain to a jackshaft and from it by sliding gears to the wheel shafts. Clutches on the latter permit either wheel to overrun the other for steering purposes, or to drive either wheel alone when the other is raised. The controls for these movements are under the left and right plough handles when the operator is walking. To make one wheel run in the furrow and the other on top of the land, each wheel is mounted on a radial arm capable of movement around the driving pinion.

The right wheel is guided by means of a handwheel and screw-and-nut steering gear. When turning around at the end of a furrow the whole frame of the machine must be lifted on the left side in order to prevent the two ploughshares from sticking into the ground while the turn is made, and for this purpose a special lifting arrangement has been devised. It consists of a double set of ratchet teeth on an extension of the radial arm carrying the left traction wheel. Two pawls are operated by a single lever on the plan that when one pawl is engaged the other is released. When the upper pawl is released the frame falls by gravity to the required position, the depth of the plowing being set by the handwheel and screw also used for guiding the right traction wheel. At the end of the furrow the lever is thrown over, disengaging the upper pawl, and the pressure of the teeth of the pinion engaging with the gear ring of the traction wheel is sufficient to raise the frame, the driving pinion climbing around the gear ring, while the movement of the lever in removing the upper pawl permits the lower one to fall into place and retain the frame in its elevated position. Thus the ploughshares are lifted to the surface of the ground without stopping the machine, and then, by driving one wheel alone, the plough is swung around one wheel as a pivot.

The addition of a seat and duplicate controls for the ploughman is an improvement devised for the latest model of this plough, which is made by Wyles Motor Ploughs, Ltd., at Leeds, England.—From *The Engineer*, April 16.



Side and plan views of recently improved small motor plough

Chemical Principles in the Protection of Iron Against Rust

TWO series of experiments to determine the chemical influences affecting the corrosion of iron are recorded in the Swiss *Bazeitung* for March 13 and 20 and establish the possibility for improving the ordinary oils and paints employed for rust protection considerably by the addition of certain chemicals. Among the facts which were found to bear on the subject were the following:

The contact of iron with other metals, especially copper and nickel, has the effect of hastening and increasing the rust formation every time these metals cause a difference in the electrical potential by contact with a liquid.

Distilled water causes rust much more readily than water charged with carbonic acid or sea water.

All solutions of metallic salts have one or more degrees of strength at which the tendency to rust formation by contact with it reaches maximum and another degree beyond which this influence is more and more reduced.

(*Continued on page* 830)

Railway Inspection Car Follows Automobile Design

Chassis of special railway car for inspection work, transportation of labor, pay car, etc., which follows automobile practice in many points of design. Note the radiator, the four-cylinder Continental M power plant, arrangement of tanks, jackshaft, running board, etc.

UNDER the stock name of No. 35 Railway Inspection car a very interesting use of the automobile engine is concealed. This is a motor-driven car with wheels designed to run upon the standard gauge rails to take the place of the locomotive for special work such as inspection, pay car, transportation of laborers, etc.

4 to 50 Miles per Hour

Speeds of from 4 to 50 miles per hour can be made with this car and, although in general construction and appearance this is strictly a railway car and not an automobile, in many respects the design follows automobile practice. Continental motors supply the power, the model M with the 30-horsepower rating being used. The motor drives through a single-plate clutch and a three-speed gearbox to a jackshaft by means of bevel gears. From the jackshaft the drive is taken by chain to each of the rear wheels, these being mounted on high-duty Hyatt roller bearings on the dead axle. No differential is required in work of this kind and by means of a double bevel gear arrangement, all speeds can be obtained in either direction and the car operated equally well either way.

Control of Automobile Type

As far as the control is concerned it is the same as an automobile. It is superior in spring suspension to the usual railway car, having a much easier riding ability, thus overcoming the fatigue generally resulting from long trips in other cars used for this same purpose. As regards the body, it is an all-weather proposition but for use in warm days can be left open, giving a pleasant relief from the stuffiness of the usual observation car. It has a full standing roof and closed ends with drop windows which are very low to allow a clear view of the track. The sides are semi-inclosed and with the side curtains pulled down an entirely closed body for winter travel is provided. There are two doors on each side, and eight seats each independent and swiveled so that they can be swung in any direction permitting observation on all sides of the car and facilitating conversation.

The utility and economy of this type of car can be appreciated when it is considered that such trips are usually made by special trains or at least in a special car attached to a regular train. Under such circumstances the officials are not free to stop at any or all points where they might desire and so are kept from getting into close touch with the different problems on their roads. This type permits them to run between trains and to stop at bridges for inspection. In fact, its usefulness is unlimited in this respect as starting and stopping does not interfere with the regular schedule of any train.

The field which is now open for this type of car should be good in view of the tendency of the railroads at the present time to have their officials get as closely in touch as possible with the details of the different lines, to say nothing of the other uses for the machine.

Railway inspection and work car complete. Note the side doors, of which there are two on each side, and fender in front. The car is designed for speeds of 4 to 50 miles per hour, having a regular automobile type three-speed gearbox. The eight seats are independent and swiveled, permitting them to face in any direction. Side curtains make it possible to completely inclose the car

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Movement for the Wider Manufacture of Small Motor Ploughs

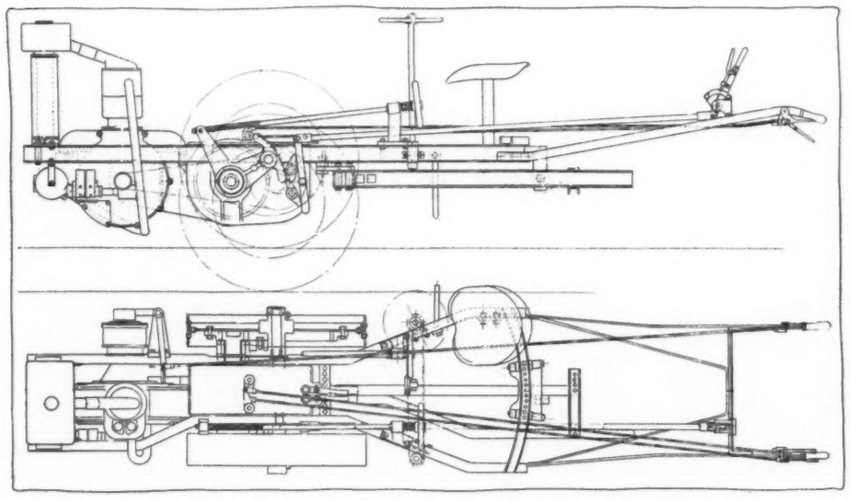
EUROPEAN MARKET TO FACILITATE DEVELOPMENTS

WITH several millions of men and horses removed from the ranks of workers, the European nations will after the war experience a very urgent need of motor ploughs and other agricultural motor machinery, and they will draw as heavily as possible on American supplies in these lines, even to the extent of placing their farm mortgages largely in the hands of American investors. As the demand for self-propelling machinery up to July 1914 was limited only by the shortcomings in construction which made it suitable and profitable only for very large estates, and favorable soil and surface conditions, the attention of designers has been turned strongly to the small working unit, and a large number of motor ploughs supposed to meet the requirements of the farmer of moderate means have made their appearance, but with regard to none of them have decisively favorable results in practice been recorded. No firmly organized co-operation of constructive and agricultural insight seems to have been effected anywhere to solve the knotty mechanical and economical problems involved, each designer apparently fancying that he can strike a happy solution alone with a few picked-up bits of information with regard to the many different things which the average farmer must be able to do with the machinery in order to make it pay, while the farmers usually imagine that they ought to be enabled to farm with machinery on just the same plan which they have always followed.

The tendency toward the small unit is illustrated in the new Wyles plough shown in the accompanying cut. It is propelled by a single-cylinder gasoline motor of 8 1-2 hp. with a two-speed gearbox. The drive is by chain to a jackshaft and from it by sliding gears to the wheel shafts. Clutches on the latter permit either wheel to overrun the other for steering purposes, or to drive either wheel alone when the other is raised. The controls for these movements are under the left and right plough handles when the operator is walking. To make one wheel run in the furrow and the other on top of the land, each wheel is mounted on a radial arm capable of movement around the driving pinion.

The right wheel is guided by means of a handwheel and screw-and-nut steering gear. When turning around at the end of a furrow the whole frame of the machine must be lifted on the left side in order to prevent the two ploughshares from sticking into the ground while the turn is made, and for this purpose a special lifting arrangement has been devised. It consists of a double set of ratchet teeth on an extension of the radial arm carrying the left traction wheel. Two pawls are operated by a single lever on the plan that when one pawl is engaged the other is released. When the upper pawl is released the frame falls by gravity to the required position, the depth of the plowing being set by the handwheel and screw also used for guiding the right traction wheel. At the end of the furrow the lever is thrown over, disengaging the upper pawl, and the pressure of the teeth of the pinion engaging with the gear ring of the traction wheel is sufficient to raise the frame, the driving pinion climbing around the gear ring, while the movement of the lever in removing the upper pawl permits the lower one to fall into place and retain the frame in its elevated position. Thus the ploughshares are lifted to the surface of the ground without stopping the machine, and then, by driving one wheel alone, the plough is swung around one wheel as a pivot.

The addition of a seat and duplicate controls for the ploughman is an improvement devised for the latest model of this plough, which is made by Wyles Motor Ploughs, Ltd., at Leeds, England.—From *The Engineer*, April 16.



Side and plan views of recently improved small motor plough

Chemical Principles in the Protection of Iron Against Rust

TWO series of experiments to determine the chemical influences affecting the corrosion of iron are recorded in the Swiss *Bazeitung* for March 13 and 20 and establish the possibility for improving the ordinary oils and paints employed for rust protection considerably by the addition of certain chemicals. Among the facts which were found to bear on the subject were the following:

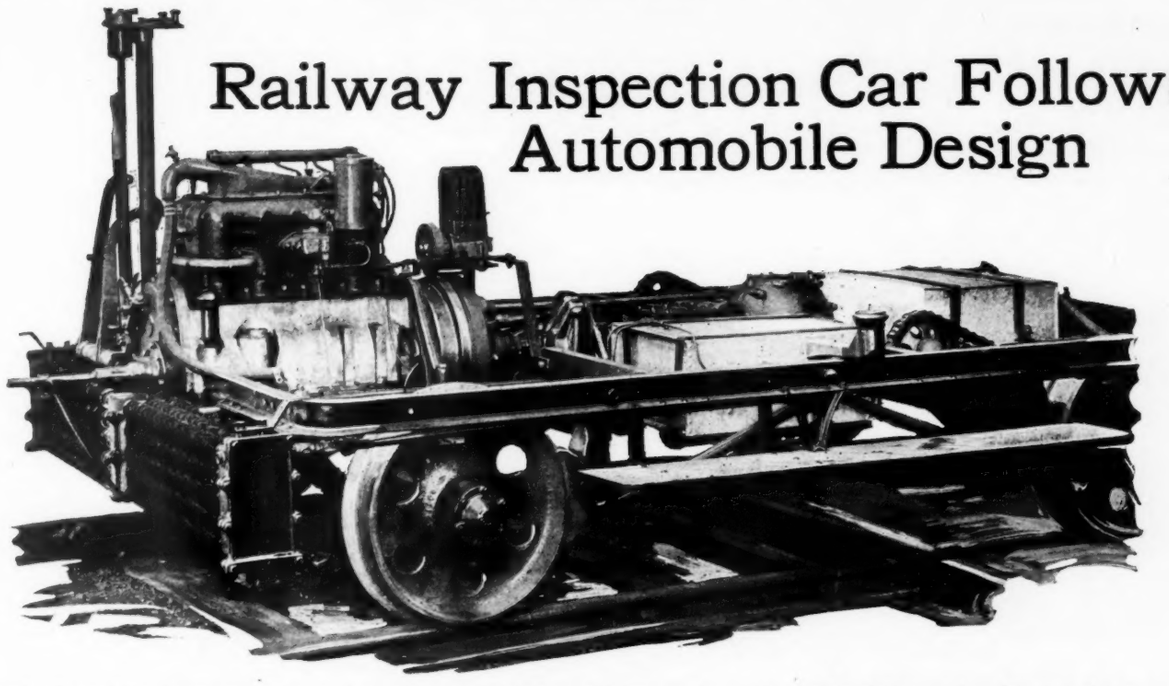
The contact of iron with other metals, especially copper and nickel, has the effect of hastening and increasing the rust formation every time these metals cause a difference in the electrical potential by contact with a liquid.

Distilled water causes rust much more readily than water charged with carbonic acid or sea water.

All solutions of metallic salts have one or more degrees of strength at which the tendency to rust formation by contact with it reaches maximum and another degree beyond which this influence is more and more reduced.

(*Continued on page* 830)

Railway Inspection Car Follows Automobile Design



Chassis of special railway car for inspection work, transportation of labor, pay car, etc., which follows automobile practice in many points of design. Note the radiator, the four-cylinder Continental M power plant, arrangement of tanks, jackshaft, running board, etc.

UNDER the stock name of No. 35 Railway Inspection car a very interesting use of the automobile engine is concealed. This is a motor-driven car with wheels designed to run upon the standard gauge rails to take the place of the locomotive for special work such as inspection, pay car, transportation of laborers, etc.

4 to 50 Miles per Hour

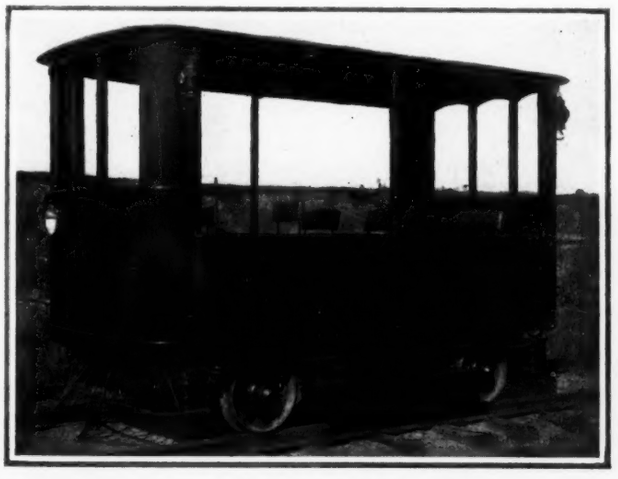
Speeds of from 4 to 50 miles per hour can be made with this car and, although in general construction and appearance this is strictly a railway car and not an automobile, in many respects the design follows automobile practice. Continental motors supply the power, the model M with the 30-horsepower rating being used. The motor drives through a single-plate clutch and a three-speed gearbox to a jackshaft by means of bevel gears. From the jackshaft the drive is taken by chain to each of the rear wheels, these being mounted on high-duty Hyatt roller bearings on the dead axle. No differential is required in work of this kind and by means of a double bevel gear arrangement, all speeds can be obtained in either direction and the car operated equally well either way.

Control of Automobile Type

As far as the control is concerned it is the same as an automobile. It is superior in spring suspension to the usual railway car, having a much easier riding ability, thus overcoming the fatigue generally resulting from long trips in other cars used for this same purpose. As regards the body, it is an all-weather proposition but for use in warm days can be left open, giving a pleasant relief from the stuffiness of the usual observation car. It has a full standing roof and closed ends with drop windows which are very low to allow a clear view of the track. The sides are semi-inclosed and with the side curtains pulled down an entirely closed body for winter travel is provided. There are two doors on each side, and eight seats each independent and swiveled so that they can be swung in any direction permitting observation on all sides of the car and facilitating conversation.

The utility and economy of this type of car can be appreciated when it is considered that such trips are usually made by special trains or at least in a special car attached to a regular train. Under such circumstances the officials are not free to stop at any or all points where they might desire and so are kept from getting into close touch with the different problems on their roads. This type permits them to run between trains and to stop at bridges for inspection. In fact, its usefulness is unlimited in this respect as starting and stopping does not interfere with the regular schedule of any train.

The field which is now open for this type of car should be good in view of the tendency of the railroads at the present time to have their officials get as closely in touch as possible with the details of the different lines, to say nothing of the other uses for the machine.



Railway inspection and work car complete. Note the side doors, of which there are two on each side, and fender in front. The car is designed for speeds of 4 to 50 miles per hour, having a regular automobile type three-speed gearbox. The eight seats are independent and swiveled, permitting them to face in any direction. Side curtains make it possible to completely inclose the car

ACCESSORIES

Superior Ford Radiator

A V-TYPE RADIATOR suitable for Ford cars is shown in the accompanying illustration. This is guaranteed for 1 year and is claimed by the maker to give double cooling efficiency, to prevent boiling over, to save fuel and oil and to increase power. With extending starting crank included this radiator sells for $34.70 in brass finish and for $38 in German silver. In conjunction with this radiator is offered the Ford streamline hood shown in the same illustration which tapers to the top of the wood dashboard and also tapers at both sides. It has a separate hood rest ready to screw on the dash. There are no exposed hinges on top, preventing rain from penetrating the hood. The four hood hooks on the wood ledge hold the new hood tightly in place. There are seven louvres or ventilator gills on each side, allowing the heated air to escape from the motor. This hood can be used in combination with the standard Ford radiator or with the V type already described. It sells for $8.—Superior Lamp Mfg. Co., New York City.

Noxal Shock Absorber

Acting on the principle that a shock absorber must have a guide at the top and bottom of the shaft, the Noxal, shown in the accompanying illustration, has a bottom guide, or bearing of bronze and dry graphite, 1 inch long and 3-4 inch in diameter, while the top, or plunger, guide is 3-4 inch high and 2 3-4 inches in diameter. These bearings are designed to insure long wear and a straight spring action at all times, eliminating side pull, rub or tipping. The springs used in the device are stiff enough for a heavy load, at the same time sensitive to the least vibration from road irregularities. Springs are of vanadium steel, while the yoke coupling and plunger rod are forgings. The plunger rod itself is 3-4-inch in diameter. The case or cover of the absorber is of steel 3-32 inch thick, the entire device being 2 3-4 inches in diameter and 5 inches long. Each pair is packed with fittings for cars with springs from 1 3-4 to 2 1-4 inches wide and shackle bolts from 1-2- to 5-8-inch in diameter. No filing, fitting or machine work is required in applying the device, which is designed for cars weighing from 2,600 to 3,800 pounds. This type sells for $10 per pair.

The Noxal absorber for Ford cars is different in design from that already described but the same materials and workmanship are employed. Like the larger type these are finished in two coats of hard black enamel. The Ford type sells for $8 per set of four.—The Noxal Co., Chicago, Ill.

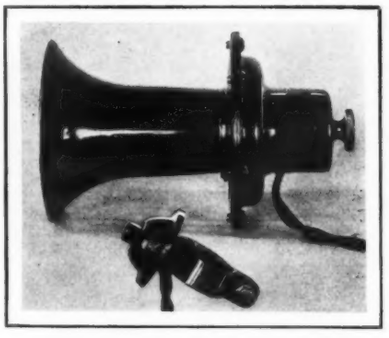
Heinze Magneto Horn for Fords

An electric horn which operates on the current generated by a Ford flywheel magneto is shown, not the least of its interesting features being the low price at which it is sold. It is of the vibrator type, the diaphragm being set in motion by the action of an armature moved by electro magnets, designed especially for the Ford magneto current. The vibrator points are of tempered tool steel.

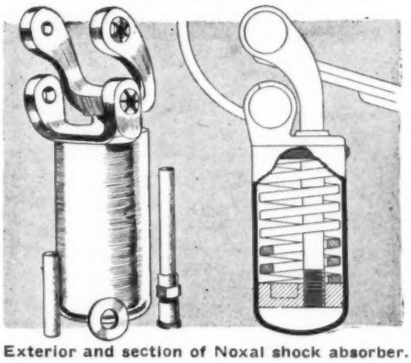
A peculiarity of the horn is that the diaphragm is of aluminum, which offers advantages in that it is light and permits extremely rapid vibration, and is proof against rust. The bell is of brass.

An extremely convenient arrangement is the adjustment by means of which the horn is regulated to give the best results with the particular magneto from which it derives its current. The adjustment operates on the vibrator and is controlled by a milled head at the rear of the casing inclosing the mechanism. By slightly turning this milled head one way or the other while the engine is running and the horn button is pressed the tone can be regulated until it is at its best.

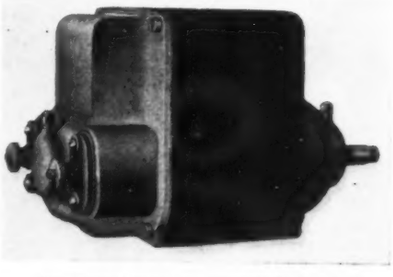
The outfit consists of the horn, button and flexible cord for carrying the current. The method of installation is simple, the horn being mounted where desired, the button clipped to the steering column or wheel, one wire attached to the magneto terminal at the top of the transmission case and the other grounded to any part of the frame or under a nut on the side of the transmission case. The horn sells for $3.50. — Heinze Electric Co., Lowell, Mass.



Heinze magneto horn for Ford cars



Exterior and section of Noxal shock absorber. A special type is also made for Fords



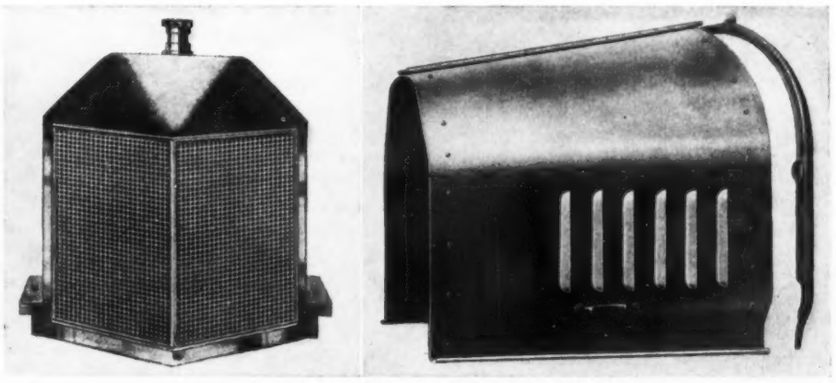
Improved type of Fisher generator

Improvements in Fisher Generator

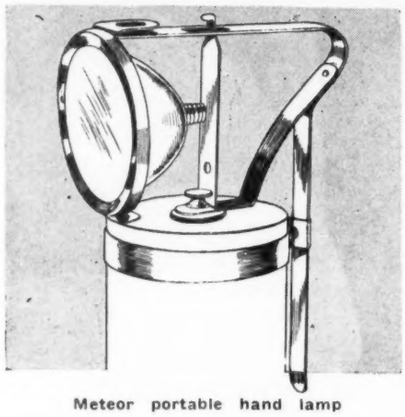
The latest Fisher generator is not different in principle from the type made by the producers for over 3 years past but it has a variety of small changes in detail that make for convenience. For instance, much weight has been saved, the generator now being only 21 pounds, and the brushes are placed so that they can be taken out and replaced with great ease. The complete lighting outfit now costs $37.50. Also the output has been increased being now 10 amperes. The Fisher machine is of the inherent regulation type and strongly constructed, while its manufacturers specialize on the production of outfits to attach to standard cars of old patterns. From stock can be obtained lighting sets to fit Overland, Ford, Cadillac, Hupmobile and R. C. H. cars of sundry models.—Fisher Electrical Works, Detroit, Mich.

Portable Hand Lamp

This is a very simple form of hand lantern that derives its supply of current from any ordinary type of dry cell and will clip on the top of a number six cell of any make. It is of no importance what form of end the central carbon pole of the cell may have, as the lantern is



Two Superior products for Ford cars. Left, V—radiator and right, tapered hood. They may be used in conjunction or separately



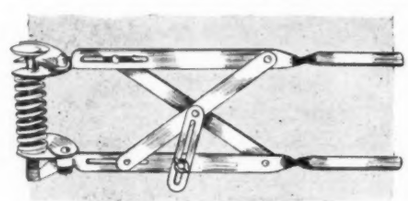
Meteor portable hand lamp

adjustable to suit any sort. For use in the garage an electric torch is, of course, much to be preferred to an oil lamp and this—known as the "Meteor"—seems to be ideally simple. The advantage of being able to use any kind of cell instead of a special sort is obvious.—Stewart-Skinner Co., Worcester, Mass.

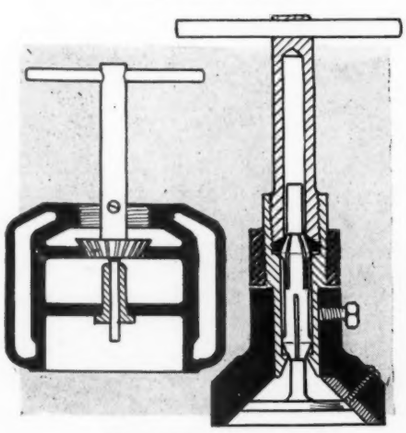
Several Paro Products

The accompanying cut of the Illinois valve remover shows it in action and gives an excellent idea of its simplicity and ease of operation. This device can be operated with one hand and the two adjustable jaws enable the worker to remove valves from the most inaccessible location. It compresses and retains the valve spring in position until the valve is replaced. Two features which will appeal to the car owner are that its action is not only easy and quick but it prevents soiling the hands. It sells for $1.

Another product of the Paro company is the Fosnacht valve reseater which is designed to cut a new seating surface on the old valve and its seat just as was done when the motor was machined at the factory. The chief advantages in the use of the instrument are said to be the preservation of the true angle and the unusual rapidity of operation, it being stated that a new seat can be given the valve by three turns of the tool. Reamers sell at $4 and $6 and special sets for repair shops are offered at $30, these being designed to provide a tool for every type and size of engine that may come into the shop.



Illinois valve remover

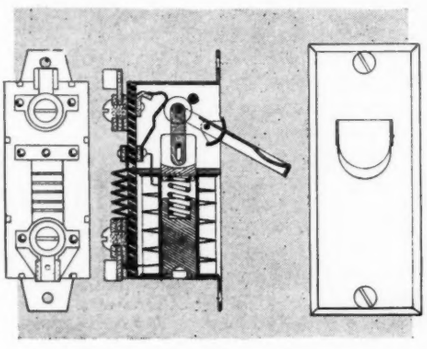


Fosnacht valve reseater

Klearglow, also produced by the Paro concern, is a one-piece all-glass device for diffusing the light of the headlamp, the surfaces of which it is composed are corrugated and arranged so that the light is softened and clarified and the dangerous glare is eliminated. The device is said to eliminate the glare without in any way reducing the volume of light cast by the lamp.—H. G. Paro, Chicago, Ill.

Automatic Safety Switch

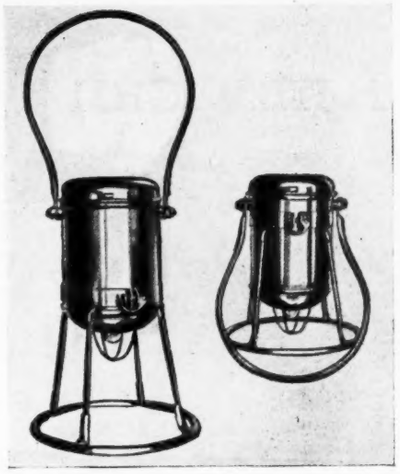
Fuses in an automobile lighting circuit are always a possible source of trouble, though they happen very seldom. Their purpose is to prevent the wires in the circuit from being overloaded and they are a great safeguard. The trouble comes when some accident causes a short circuit, a rush of current and a "blow." It is then necessary to replace the fuse by a new one, after locating and curing the fault. Thus spare fuses have to be carried, as it is extremely dangerous to cut out a fuse by wiring it up with a bit of copper as is often done in emergency when no spare fuse is available. The Hartman automatic switch is a simple mechanical device which automatically switches off any circuit if the current in it exceeds the safe amount. It is operated by a small electro-magnet that pulls the contacts apart directly the current becomes too strong. Thus it is as effective as the fuse, while no part of it burns out to give the break in the circuit. All sorts of units are made from a single switch to gang switches that can control every circuit on a car and the prices naturally vary a good deal. A single unit costs $1.50 with face plate for attaching it, and a four switch plate costs $5.50. Automatic starter switches and ignition switches are also made by the same firm.—Hartman Electrical Mfg. Co., Mansfield, O.



Hartman automatic safety switch

Safety Hand Lantern

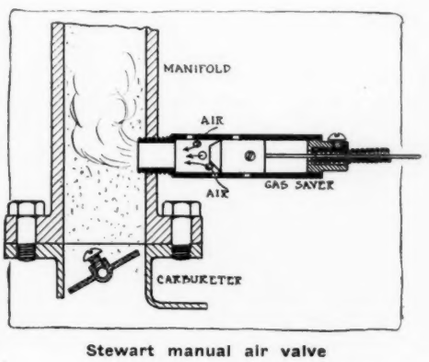
The feature of the Federal electric hand lantern is that it casts no shadow on the ground beneath it. Instead of having the lamp at the top with a solid base beneath, it has an open foot consisting of a ring and four legs, so that the light is strong immediately under the hand of the person carrying it as well as spread all around. It is fed with current from a special dry cell that is easy to replace, and clips are supplied to fasten the lamp to the running board of the car. It is very compact when folded and the lamp bulb is well protected, while there is a space inside the dry cell where a spare bulb can be put. The price of the lantern is $4.50. A vertical pattern of hand lamp with a conical reflector top and both swinging and fixed handles is sold for $2.—Federal Sign System, Chicago, Ill.



Federal safety hand lantern which casts no shadow on the ground beneath it

Manual Air Valve

The Stewart gasoline saver is a simple little fitting for attachment directly to the intake manifold. As can be seen from the drawing, it is a length of tube threaded at one end and drilled with a series of small holes. Inside there is a piston which motor suction tends to draw down to the bottom of the tube, so closing all the little holes, but a wire control carried to the steering post allows the piston to be drawn back, so uncovering one or more holes and letting air into the manifold. The device is the extreme of simplicity and could not fail to prove its ability to save fuel if used by the driver in an intelligent way. A manual device is preferred by most experts to an automatic, because they enjoy using it, but this is so simple that it should appeal to the least expert, too, as there is nothing to be learned or understood about it. The price is $5 for the small size and $6 for a larger pattern.—Alfred C. Stewart Machine Works, Los Angeles, Cal.



Stewart manual air valve

American-Made Chassis Lead in Australian Trade

United States' Share of Commonwealth's 1914 Imports $2,154,420—Gain of $468,-350 Over 1913—United Kingdom's Share $2,152,330, or Only $2,090 Less Than That of U. S.

IMPORTS of American-made automobiles and trucks into the Commonwealth of Australia are yearly making great strides and have gradually caught up to and passed those of their rival, the United Kingdom, which, on account of the war, has curtailed its shipments into that country and has thus lowered its export figures there. The latest statistics show large increases in all departments for the United States, the most marked being those in chassis. This country in 1914 exported to the Commonwealth chassis amounting in value to $2,154,420, an increase of $468,-350 over 1913. The United Kingdom exported chassis amounting in value to $2,-152,330, just $2,090 lower than the figures from the United States. Incidentally, this is the first time that the United States chassis exports have been greater than those of the United Kingdom.

U. S. Chassis Gain

Imports of chassis into the six states of the Commonwealth from the United States, showed gains in each for 1914. New South Wales led with $797,675 with Queensland second with $470,620. From latest reports it is shown that 79 per cent. of the cars sold in those states have gone into the country districts where farming and pasturage constitute the chief occupations. With this class of population purchasing practically 80 per cent. of the cars, it is not surprising that the low-powered and medium-priced cars should lead.

New South Wales also led in chassis imports from the rest of the world, the amount being $2,449,625, over one-third of the total, which amounted to $6,748,925 compared with $6,667,750 in 1913. This state also led in body imports, which amounted to $192,620, compared with $170,725 in 1913. Victoria was second in point of chassis and bodies, her chassis imports amounting to $2,148,540 and her body imports to $106,965. Queensland was third, chassis imports amounting to $871,640 and body imports to $215,600.

Queensland showed the largest increase in imports of American-made automobiles and trucks with New South Wales second. The 1914 increase of Queensland was $161,130 and that of New South Wales, $133,915.

All of the states, with the exception of Victoria, showed large increases in their total chassis imports. New South Wales led with a gain of $183,810 over 1913 and Queensland came second with a gain of $101,845. Victoria's drop was $235,125.

Canada Well to the Front

Though the United States showed the largest exports to the Commonwealth and also the largest gains, Canada was a close second in the latter. It might be added, however, that the Canadian imports were principally made up of Fords from the Walkerville factory. The United Kingdom, which was second in value of imports, fell way below its 1913 imports, just $278,980. This was due to the concentration of all its truck manufacturing for war purposes. The manufacture of automobiles has also been turned to war purposes.

A Fifty-Fold Increase Since 1909

American automobile and truck imports into Australia since 1909 have amounted to more than $10,000,000. From the figure of $50,625 in 1908, this value has risen to $2,707,780 in 1914, or nearly fifty times its magnitude. This country as an automobile buying territory, has made most astonishing headway in the last 5 years. Agriculture, mining and a variety of industries make that country a territory of considerable buying power. That the automobile industry is getting its share is manifested in the importation of $7,930,465 worth of chassis and bodies in 1914.

Automobile and Motor Truck Chassis and Bodies and Motorcycles Imported into Australia in 1914

CHASSIS FOR AUTOMOBILES AND TRUCKS

Country of Origin	N. S. W.	Vic.	Queens-land	S. Aus.	W. Aus.	Tas.	Total
United Kingdom	$801,875	$704,360	$185,645	$304,255	$88,325	$67,870	$2,152,330
Canada	338,480	295,520	160.125	173,255	50,310	44,910	1,062,600
India	.....	4,115	.....	.....	.....	.....	4,115
New Zealand	50	2,425	.....	.....	.....	.....	2,475
Austria	1,210	1,560	1,780	.....	.....	.....	4,550
Belgium	58,185	58,300	11,895	3,755	30	.....	132,165
France	184,790	297,505	27,590	52,390	13,595	10,665	586,535
Germany	156,785	187,065	10,990	13,445	195	4,265	372,745
Italy	110,575	129,675	2,995	20,610	6,635	.....	270,490
Netherlands	.....	475	.....	.....	.....	.....	475
Switzerland	.....	5,625	.....	400	.....	.....	6,025
U. S. America	797,675	466,915	470,620	254,620	133,855	35,735	2,154,420
Total	$2,449,625	$2,148,540	$871,640	$822,730	$292,945	$165,445	$6,748,925

BODIES FOR AUTOMOBILES AND TRUCKS

United Kingdom	$147,415	$76,180	$34,820	$44,050	$21,760	$13,335	$337,560
Canada	75,660	51,485	40,870	38,015	12,540	10,390	228,960
India	.....	440	.....	.....	.....	.....	440
New Zealand	225	570	.....	.....	.....	.....	795
Austria	.....	380	.....	.....	.....	.....	380
Belgium	1,135	2,585	580	.....	.....	.....	4,300
France	6,950	8,060	1,920	2,410	1,055	60	20,455
Germany	11,955	3,110	575	1,320	.....	280	17,240
Italy	8,245	5,510	.....	1,885	2,230	.....	17,870
Netherlands	.....	180	.....	.....	.....	.....	180
U. S. America	192,620	106,965	136,835	74,145	35,580	7,165	553,360
Total	$444,205	$255,465	$215,600	$161,875	$73,165	$31,230	$1,181,540

MOTORCYCLES, ETC.

United Kingdom	$277,670	$230,020	$26,465	$89,560	$57,475	$29,905	$711,045
New Zealand	.....	495	.....	.....	.....	.....	495
Canada	.....	6,390	.....	.....	.....	.....	6,390
Belgium	9,605	.....	3,125	.....	.....	.....	12,730
France	265	115	770	1,235	1,105	.....	3,490
Germany	2,165	630	.....	280	5	.....	3,080
Netherlands	75	.....	.....	.....	.....	.....	75
Switzerland	2,385	655	.....	.....	.....	.....	3,040
U. S. America	6,920	132,600	3,410	5,000	2,725	455	151,110
Total	$299,085	$370,905	$33,720	$96,075	$61,310	$30,360	$891,455

The Automobile

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EDITORIAL

David Beecroft, Directing Editor
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Chassis Construction

IS the structural chassis design of today a scientific solution of the problem of stress on the various component parts, or is it a development which still shows traces of an ancestral horse vehicle? If it is the latter, there is hardly any doubt but what a scientific solution of the chassis problem will make important changes in practice. If the automobile chassis is merely a descendent from the frame work of the horse-drawn vehicle it would be beyond the realm of possibility that its structure would be the same were it approached by a bridge-designer, for instance, who had never seen the working drawing of either a horse-drawn vehicle or an automobile.

Very few, if any, automobile engineers have seen an actual stress sheet such as is common in bridge practice worked out for an automobile. Yet, certainly as regards its static loads and many of the dynamic stresses, the bending moments, sheering stresses, etc., are well within the possibility of calculation. The question is if the disposition of the material is the same in present design as it would be were it worked out to meet the conditions of a carefully worked-out stress sheet.

If the material which is added for the sake of beautifying the chassis can be utilized in such a way as to be a part of its structure the result is almost bound to be a lighter vehicle than when the beautifying material is added after the structure has been completed. Furthermore, if this could be done it would eliminate to a large extent the use of the lighter sheet metal parts and consequently eliminate one of the big factors for producing noise in a car which has seen a limited amount of service. It is not altogether possible that the methods used in bridge design could be transferred immediately to automobile practice, because there are certain demands which must be met in the way of the location of the center of gravity and in appearance. There are, however, parts where bridge practice could probably be employed to great advantage by permitting a scientifically disposed mass of material to perform duties which would be beyond the strength of material not so carefully arranged. For example, considering pure sagging stresses, the modulus of a section through the car frame would be the deciding factor. Therefore in deciding the bending moment this naturally would depend to a large extent on the material furthest removed from the center of the car. The location and arrangement of bends in the frame members and cross members are factors which have an all-important bearing on weight and strength.

1916 Motors

THOUGH the motor manufacturers are keeping information regarding their plans for 1916 very much in the background, enough leaks out now and then to show that the promise of the 1915 designs is likely to be fulfilled. That is to say the maximum crankshaft speeds will be higher than ever and the engines will be set so that the highest horsepower is attained at greater crankshaft speeds than heretofore.

Just at present it is to be observed in the conversation of engineers at informal gatherings such as always follow S.A.E. meetings and the like, that the high-speed four, the high-speed eight and the twelve are all expectations. That is to say 1916 is expected to produce many small fours of fairly high power and low gearing. Eights are expected to increase in numbers, and twelves to make their bow, while it is beyond all doubt that at least one of the largest firms of motor makers has a twelve practically ready for whoever may want it.

Apart from this, however, which is more or less common gossip, there is a good number of men who consider that the light, high-speed six has never had a proper chance to show its capabilities, and when many of the engineers are agreed on a point like this it is safe to argue that several makers at least will come along with a six of high volumetric efficiency. There seems general agreement that the day of the large, slow-speed six, giving its full power at 1,200 to 1,500 revolutions is doomed, that the motors with more than six cylinders, or the light high-speed six will oust it from the position it has held so long. This means that every motor manufacturer is working up the power per cubic inch and this will undoubtedly lead to considerable changes in detail design. This fall will surely see the introduction of a great many interesting developments in the internal economy of American automobile engines.

Forty-One Cars Will Start in Indianapolis Trial Heats

Two of Four Sunbeams Entered Only Ones with Six-Cylinder Engines—Ten Foreign Entries—Prizes Total $52,300—Bugatti Only Car with 300-Inch Displacement

INDIANAPOLIS, IND., May 4—Entries for the next Indianapolis 500-mile race on May 29 have closed with forty-one cars registered. The name of René Thomas will not be found among the starters. Thomas, after cabling his entry to the speedway management early in the spring, found it impossible to interest the Delage factory in loaning him a car, because of the war, and finally, though he tried until the last minute, failed to raise enough capital to buy the machine.

Looking over the list of entries, marked variations in motor sizes, etc., are seen; for instance, the Cornelian, which will be driven by Chevrolet, has a piston displacement of only 103 inches, the smallest car in the race, both in the latter respect and also in weight, this being only 1,000 pounds. The other extreme in respect to piston displacement is Oldfield's Bugatti with 300 inches. The heaviest car in the race is Cino, driven by McNay, with a weight of 2,450 pounds.

Despite the size of the entry list, some slight disappointment comes with the knowledge that no name of a previous winner appears. Harroun, who finished first in 1911; Dawson, 1912 winner; Goux, 1913 hero; and Thomas, who came in first last year, all are missing.

Ten Foreign Entries

There are ten foreign entries, representing five manufacturers. Four of these are Sunbeams; three are Peugeots; one a Bugatti; one a Mercedes; and one a Delage. America is even better represented. In the list, there are the products of half a dozen American factories. Also, there is the usual number of more or less mysterious American entries, the list this year revealing twelve makes that have been kept under cover until the last minute.

Just which of the forty-one entries actually will start in the race is problematical and will not be known until after the speed trials on May 20, 21 and 22. On these days the cars will be put through their paces in the inverse order of their entry and to be eligible to start they must show a speed of 80 miles an hour for one complete lap of the 2 1-2-mile course. As if more than three cars of any one make are entered only the fastest three can start, one of the Sunbeams surely will go. Only thirty-three cars will be permitted to start. The cars are to be numbered according to the speed they show in the preliminary trials, the fastest car receiving No. 1 and starting next the pole.

In order to make identification easy, each car is to be painted according to the International method. That is, German cars will be white; Belgian, yellow; French, blue; English, green; Italian, red; and American, red and white. The make of car and not the nationality of the driver will determine the colors.

As compared with previous 500-mile races, this year's race is at present on a par with the first event staged in 1911. For that race there were forty-one starters, the largest in the history of 500-mile races. The following year, twenty-four cars came to the line, this being the smallest number to start. In 1913 there were twenty-seven starters and last year thirty drivers faced the starter.

Many Well-Known Names

Even though there are no previous winners entered, the entry list contains many names which have become well-known to racing enthusiasts. For example, there is DePalma and his Mercedes; neither Carlson nor Rickenbacher of the Maxwell team need any introduction to racing fans; Chassagne and Coatalen, the Sunbeam team, are new to American racing, but both have enviable records abroad; Chevrolet has not been seen at the wheel of a racing car since his last appearance in a Vanderbilt race on Long Island, though his name and his prowess nevertheless are familiar; everyone knows Pullen, Mercer pilot, for who could forget his memorable and record-smashing Grand Prize victory? Resta, too, has carried off a Grand Prize, to say nothing of a Vanderbilt and foreign trophies too numerous to mention; and there are the Bergdoll brothers; Nikrent, the veteran Barney Oldfield, Hughie Hughes, Neil Whalen, Grant, twice Vanderbilt Cup hero, Burman and Chas. Keene, all of whom have made names for themselves.

Of the American cars, probably the three Porter-Knights' which are described and illustrated in this issue, will attract as much attention as any for this is the first time that a team of specially-built, Knight-motored cars has entered on American soil. These cars are wonderful creations, as is revealed by their horsepower curves—122 horsepower at nearly 4,000 r.p.m.—and their speed on the road; one has made over 100 miles an hour in practice. Then there are the Maxwells, a doughty team; the Stutz cars, the Duesenbergs, and the Mercers.

The speed that will be made is highly problematical though there is reason to believe that old records may go by the board despite the fact that the piston displacement this year has been set at 300 cubic inches. In 1911, Ray Harroun, in a Marmon, won the first race at an average speed of 74.8 miles an hour. Dawson averaged 78.72 miles an hour the next year with a National; and in 1913

List of Entries for Indianapolis 500-Mile Race

Car	Driver	Cylinders	Bore & Stroke	Displacement	Nation	Entrants
Maxwell	Carlson	4	3.8 x 6.8	298	America	Maxwell Motor Sales Corp.
Maxwell	Rickenbacher	4	3.8 x 6.8	298	America	Maxwell Motor Sales Corp.
Maxwell	——	4	3.8 x 6.8	298	America	Maxwell Motor Sales Corp.
Mercedes	De Palma	4	——	—	Germany	E. C. Patterson
Sunbeam	Coatalen	4	3.7 x 6.3	270.9	England	Louis Coatalen
Sunbeam	Chassagne	4	3.7 x 6.3	270.9	England	Louis Coatalen
Du Chesneau	Brown	4	3.3 x 5.5	183	America	C. A. Du Chesneau
Duesenberg	Alley	4	4 x 6	299	America	F. S. Duesenberg
Duesenberg	O'Donnell	4	4 x 6	299	America	F. S. Duesenberg
Duesenberg	——	4	4 x 6	299	America	F. S. Duesenberg
Cornelian	Chevrolet	4	2.9 x 4	103	America	Blood Bros. Machine Co.
Delage	J. De Palma	4	4 x 6	299	France	J. E. Wilson
Stutz	——	4	3.8 x 6.5	296	America	Stutz Motor Car Co.
Stutz	——	4	3.8 x 6.5	296	America	Stutz Motor Car Co.
Stutz	——	4	3.8 x 6.5	296	America	Stutz Motor Car Co.
Peugeot	Resta	4	3.7 x 6.9	274	France	Peugeot Auto Import Co.
Peugeot	——	4	3.1 x 6.1	183	France	Peugeot Auto Import Co.
Peugeot	——	4	3.1 x 6.1	183	France	Peugeot Auto Import Co.
Bergdoll	E. Bergdoll	4	4 x 5.9	299	America	G. C. Bergdoll
Bergdoll	J. Bergdoll	4	4 x 5.9	299	America	G. C. Bergdoll
Mercer	Pullen	4	3.8 x 6.8	298	America	Mercer Automobile Co.
Mercer	Ruckstall	4	3.8 x 6.8	298	America	Mercer Automobile Co.
Mercer	Nikrent	4	3.8 x 6.8	298	America	Mercer Automobile Co.
Bugatti	Oldfield	4	3.9 x 5.9	300	Germany	C. W. Fuller
Bergdoll	Haupt	4	4 x 5.9	299	America	G. C. Bergdoll
Emden	——	4	4.3 x 5.3	298	America	R. E. Donaldson
Porter-Knight	Hughes	4	3.8 x 6.1	270	America	F. R. Porter
Porter-Knight	Keene	4	3.8 x 6.1	270	America	F. R. Porter
Porter-Knight	Whalen	4	3.8 x 6.1	270	America	F. R. Porter
Sebring	——	4	4 x 6	299	America	E. E. Miles and J. W. Gwin
Sunbeam	Grant	6	3.2 x 5.9	278	England	Fortuna Racing Team, Inc.
Sunbeam	Limberg	6	3.2 x 5.9	278	England	Fortuna Racing Team, Inc.
Cino-Purcell	Cox	4	4.4 x 5	299	America	W. R. Purcell
Burman	Burman	4	3.6 x 7.1	298	America	Bob Burman
Harroun	Orr	4	3.8 x 6.8	298	America	Ray Harroun
Mulford	Mulford	4	3.7 x 7	299	America	Luther Brown
Cino	McNay	4	4.4 x 5	299	America	E. D. McNay
Kleinart	Klein	4	5 x 6	299.5	America	E. E. Klein
Mais	Mais	4	——	—	America	J. A. Mais
Shambaugh Spec.	Shambaugh	4	——	—	America	Charles Shambaugh
Bals Special	Hill	4	4.5 x 4.5	286.3	America	N. B. Bals

Jules Goux, with a Peugeot, averaged 75.92 miles an hour. In the last event, René Thomas, at the wheel of a Delage, turned the 500 miles at an average rate of 82.47 miles an hour.

Prizes Over $52,000

There will be $50,000 in cash prizes from the Indianapolis Speedway management to be divided up in ten portions as follows: first, $20,000; second, $10,000; third, $5,000; fourth, $3,500; fifth, $3000; sixth, $2,200; seventh, $1,800; eighth, $1,600; ninth, $1,500, and tenth, $1,400.

The Bosch Magneto Co., New York City, follows its custom of past years, offering cash prizes. It will award $1,000 in prizes to cars using its magneto and $300 to cars using Bosch plugs and magneto as well. The winner using the Bosch magneto, will receive $500, second will receive $300 and third, $200. The first three winners using both Bosch plugs and magnetos, will each receive $100.

The Emil Grossman Mfg. Co., New York City, is offering a cash prize of $1,000 to the winner of the race. The award is conditional on Red Head spark plugs being used exclusively.

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Slade to Judge Automobile Exhibits at Exposition

NEW YORK CITY, May 4—A. J. Slade, consulting engineer of this city, has been selected as one of the committee to pass on the automobile exhibits at the Panama-Pacific Exposition and left for the Pacific Coast last week.

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Saxon Travels 4,642 Miles in 30 Days

NEW YORK CITY, May 5—A Saxon roadster has completed its 30-day run between New York City and Albany, covering a distance of 4,642 miles in that time. Each day it made a one-way trip, covering over 154 miles. The car was a stock model and averaged better than 31 miles to the gallon of gasoline; 75 miles to the pint of oil. The operating cost was 1-2 cent a mile. The car used one set of Firestone all-weather tires throughout the run.

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Galbraith Appointed Savidge Steering Eastern Representative

INDIANAPOLIS, IND., April 30—A. C. Galbraith, well known in the accessory trade, has just been appointed eastern representative for the Savidge Steering Device Co., this city.

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Hess-Bright to Increase Plant

PHILADELPHIA, PA., May 4—The Hess-Bright Mfg. Co., of this city, will soon complete an addition to its present bearing factory which will materially increase its capacity. The new building is a brick structure conforming in style to the original factory.

Cleveland Police and Offending Automobilists Start Anew May 1

Offenses After That Date Considered as First—$25 a Car for Bond on Second—Headlight Rule Strict—Studebaker Declares First 5% Common Stock Dividend

CLEVELAND, O., April 30—Cleveland officials at conference April 27 decided to deal with speed and traffic violators along revolutionary lines. For some time conditions in this county, where there are more than 20,000 licensed automobiles, have been chaotic, owing to changes in laws governing motorists. Scores of cases have been brought to police court, fifty-two automobile cases alone having been disposed of by small fines in police court April 27.

The Cleveland police and prosecuting officials now propose to grant a general amnesty to all unpunished offenders, to wipe the slate clean, giving every one an immunity both for all past offenses and grievances May 1. On that date the police and automobilists will start on an equal footing.

After May 1 all offenders against any laws relating to motor traffic will be treated as first offenders. A set of the laws has been printed and copies are being distributed broadcast. The new policy will be not to make an arrest for first offenders, but they will be taken to the nearest police station, where they will be registered and all the details concerning their alleged infraction of the laws listed. The information will be forwarded to a central bureau at police headquarters for reference.

When a registered first offender is detected in a second offense he will be arrested and taken to the police station, where his record of the first offense will be consulted. Automobilists will not be detained in a cell at the station, but will be permitted under the new state law to deposit $25 cash bond or leave their machines at the precinct police station and then personally go to the central station to obtain bail. The money deposit or machine will be returned when he presents regular bail bond.

In the matter of headlight violations the procedure is exceptional. In such a case a second offense violator will be compelled to remain at the station under arrest until bail is brought to him, the same as any other misdemeanant. The reason for this is that the state law providing for putting up the car or cash as security for bail does not include headlight violators.

Studebaker Common Pays Initial Dividend of 5 Per Cent.

NEW YORK CITY, May 5—The directors of the Studebaker Corp. declared yesterday an initial dividend of 1 1-4 per cent. for the current quarter on the common stock. Payment will be made June 1 to shareholders of record May 20. The usual quarterly disbursement of 1 3-4 per cent. on the preferred was ordered.

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Anderson Joins Sales Force of Fisk Rubber Co.

CHICOPEE FALLS, MASS., May 3—Justus D. Anderson, formerly president of the Hartford Rubber Works Co. and later sales manager of the merged companies doing business under the name of the United States Tire Co., has joined the sales department of the Fisk Rubber Co. here, and will assume his new duties May 3.

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Westinghouse Co. To Buy Stevens Duryea Plant

NEW YORK CITY, May 5—The Westinghouse Electric & Mfg. Co. has taken options on several manufacturing plants in New England, including the J. Stevens Arms & Tool Co., Chicopee Falls, Mass. The Stevens-Duryea Automobile Co.'s plant, controlled by the arms company, is included in the arrangements.

These plants, it is said, will be used to fill rifle orders, recently received from a foreign government.

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Bodman, of London, in Detroit

DETROIT, MICH., May 4—W. L. Bodman, general manager of Peters & Sons, London, Eng., representatives of the Scripps-Booth passenger car and the signal truck, is in Detroit this week in the interest of shipments of these machines.

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Findeisen Calls on Detroit

DETROIT, MICH., May 1—Walter Findeisen, sales manager of the Findeisen & Kropf Mfg. Co., Chicago, manufacturer of Rayfield carbureters, reached this city Friday to call upon the manufacturers.

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Rice Leaves for 2-Weeks' Trip in South

INDIANAPOLIS, IND., May 1—H. H. Rice, sales manager of the Nordyke & Marmon Co., left Wednesday for a 2 weeks' trip through the south. He will visit Memphis, Birmingham, New Orleans, Atlanta, Knoxville, Chattanooga and Louisville, calling on Marmon dealers.

137 Franklin Dealers Average 32.1 M. P. G. in Fuel Economy Test

Highest Average Is 55 Miles Per Gallon and Lowest 18.3—All Sorts of Weather Encountered—Results Better Than Last Year

SYRACUSE, N Y., May 3—Traveling over roads of every condition in practically every state in the Union and under all sorts of weather conditions, 137 Franklin dealers on Saturday, piled up a grand average of 32.1 miles on a single gallon of gasoline. This is the second event of the kind to be run off by the Franklin Automobile Co., this city. The first took place a year ago when ninety-four dealers averaged 32.8 miles on 1 gallon.

The demonstration this year was run along the same lines as last year's and also brought to light some unusual figures. The high record of the demonstration was made in New Haven, Conn., by Cowles Tolman, who covered 55 miles under the supervision of Professors Lockwood and Prentice of Yale University. The low record came from Oil City, Pa., where, due to cold weather and heavy road conditions, Phinney & Sloan covered but 18.3 miles.

Four of the entrants covered 50 miles or better; fifteen obtained 40 miles or better, and eighty-three traveled 30 miles or more. Last year the best record made was 51.2 miles and the lowest 17.2.

Reference to the accompanying table of results shows a wide variance in road and weather conditions. In 15 per cent. of the territories there was rain; in thirty localities high winds blew all during the demonstration, Chicago, Buffalo, Cleveland, Detroit and some other lake points reporting 50-mile gales. At Colorado Springs, where the altitude is nearly 10,000 feet, the G. W. Blake Auto Co. obtained 30.7 miles in a high wind before the gallon of fuel was exhausted. At Walla Walla, Wash., and Ishpeming, Mich., where good roads are the exception rather than the rule, the Franklin Motor Car Co. and E. R. Nelson got 34.2 and 27.9 miles, respectively.

In every case the car used was a stock six-cylinder machine and no special preparations were made for the demonstration. The tires were inflated to approximately 75 pounds and fuel testing between 60 and 65 degrees was used. The gallon measure was in each case certified by the local Bureau of Weights and Measures. Each car carried two observers in addition to the driver. Routes were chosen which would give as many different kinds of road conditions as possible. The average speed was approximately 18 miles per hour.

Departing slightly from last year's practice, many of the cars carried prominent technical authorities from such representative universities as Toronto, Rensselaer Polytechnic, Brown, Armour Institute, Stevens Institute, Sheffield Scientific School of Yale, Cornell, Pennsylvania, Syracuse, Massachusetts Institute of Technology, Cincinnati, Washington, Nebraska, Lehigh, and Pratt Institute of Brooklyn, N. Y.

Bradfield To Head King's New Department of Sales

DETROIT, MICH., May 4—H. C. Bradfield, of Indianapolis, is now associated with the King Motor Car Co., of this city, as head of a new department in sales. Bradfield has lately been associated with the Premier Motor Mfg. Co.

Form National Jitney Assn.

Delegates at Kansas City Advocate Business Methods —Insurance Plan

KANSAS CITY, MO., May 4—*Special Telegram*—A dozen jitney bus operators, representatives of associations in Missouri, Kansas, Iowa, Illinois, Oklahoma and Texas, started the first national jitney association here today, by naming temporary officers and going into committee session to perfect a permanent society.

Results of National 1-Gallon Test by 137 Franklin Dealers

City	Dealer	Roads	Weather	Record
Aberdeen, S. D.	G.M. Worthington	Rough	Windy	22.7
Akron, O.	A. Auble, Jr.	Good	Fair	51.8
Albany, N. Y.	C. G. Heck	Heavy	Rain	30.5
Amboy, Ill.	A. Aschenbrenner	Good	Cold	25.6
Athens, O.	C. H. Welch	Dry	Clear, Cold	31.8
Atlanta, Ga.	W. M. Hull	Rough	Clear	31.3
Auburn, N. Y.	G. H. Leonard	Muddy	Rain	31.4
Baltimore, Md.	W. F. Kneip	Good	Clear	38.0
Bar Harbor, Me.	F. L. Savage	Muddy	Rain	22.2
Billings, Mont.	Arthur Barth	Muddy	Rain	20.0
Binghamton, N. Y.	S. H. Lewis	Muddy	Rain	27.0
Boston, Mass.	Otto Lawton	Fair	Bad	39.9
Brooklyn, N. Y.	G. B. Perkins	Fair	Rain	36.1
Buffalo, N. Y.	George Ostendorf	Fair	Gale	26.2
Canton, O.	G. W. Belden	Good	Windy	43.5
Carthage, Mo.	A. L. Caulkins	Muddy	Clear	36.0
Charlotte, N. C.	J. D. Woodside	Fair	Rain	36.2
Chattan'ga, Tenn.	J. H. Alday	Dry	Cloudy	30.3
Chicago, Ill.	F. H. Sanders	Good	Gale	30.7
Cincinnati, O.	Newman Samuel	Dry	Clear	35.7
Cleveland, O.	R. H. Eckenroth	Fair	Gale	24.4
Colo. Springs, Col.	G. W. Blake	Fair	Gale	30.7
Columbia, S. C.	Wm. Gibbes	Good	Warm	26.1
Columbus, O.	O. C. Belt	Dry	Cold	31.7
Concord, N. H.	W. E. Darrah	Wet	Cold	33.6
Cortland, N. Y.	J. A. Farrell	Wet	Rain	28.8
Dallas, Texas	W. G. Langley	Good	Fair	38.6
Danvers, Ill.	Frank Simpson	Fair	Clear	31.5
Dayton, O.	F. B. Heathman	Good	Gale	30.5
Decatur, Ill.	C. E. Dawson	Dry	Clear, Cold	32.9
Denver, Colo.	F. C. Cullen	Heavy	Windy	21.0
Des Moines, Ia.	S. P. Johnston	Good	Windy	34.2
Detroit, Mich.	W. J. Doughty	Fair	Cold, W'dy	42.3
Duluth, Minn.	J. T. Peacha, Jr.	Heavy	Rain	35.2
Eau Claire, Wis.	G. R. Wood	Fair	Cold W'dy	26.7
Elizabeth, N. J.	F. V. Price, Jr.	Poor	Rain	40.8
Elmira, N. Y.	Fred M. Jones	Muddy	Cloudy	31.4
Erie, Pa.	John Griffith	Fair	Cold	31.5
Fall River, Mass.	Ernest Place	Fair	Cold, Fair	37.8
Falmouth, Mass.	F. W. Crocker	Heavy	Foggy	28.9
Fleetwood, Pa.	Wilson Sell	Fair	Rain	34.1
Fort Wayne, Ind.	L. Ohnhaus	Good	Windy	31.9
Galesburg, Ill.	E. T. Byram	Dry	Fair, Cool	22.6
Geneva, N. Y.	W. W. McCarroll		Rain	34.5
Georgetown, Tex.	T. J. Caswell	Dry	Fair	23.6
Gr'd Forks, N.D.	J. W. Lyons	Heavy	Cold	24.3
G'd Rapids, Mich.	J. R. Jackson	Fair	Windy	28.1
Great Falls, Mont.	B. D. Whitten	Dry	Cold	37.6
Greensburg, Pa.	E. L. Turner	Dry	Fair	28.6
Greenville, S. C.	R. N. Tannahill	Dry	Fair	34.4
Hampton, Va.	J. V. Bickford	Fair	Gale	22.0
Hartford, Conn.	H. P. Seymour	Good	Showers	40.4
Helena, Mont.	W. L. Swendeman	Muddy	Cloudy	18.4
Holtville, Cal.	W. J. Seat	Sandy	Fair	24.1
Hoosick, N. Y.	John Moseley	Fair	Rain	36.4
Houston, Tex.	Rudolph B. White	Rough	Gale	22.5
Indianapolis, Ind.	Glenn Diddel	Good	Cool, Cl'dy	35.0
Ishpeming, Mich.	E. R. Nelson	Heavy	Rain	27.9
Ithaca, N. Y.	H. L. Cobb	Fair	Showers	30.4
Jacksonville, Fla.	W. F. Winchester	Dry	Warm	30.0
Kankakee, Ill.	F. A. Babel	Good	Clear, Cool	29.1
Kansas City, Mo.	E. F. Williams	Fair	Cool, W'dy	43.7
Kingston, N. Y.	W. M. Davis		Cloudy	32.3
LaCrosse, Wis.	Alfred James	Dry	Fair	29.0
Lake Park, Iowa	H. C. Meyer	Rough	Cloudy	27.6
Lexington, Ky.	V. K. Dodge	Dry	Fair	33.5
Lincoln, Neb.	Fred M. Ryan	Rough	Gale	24.6
Little Rock, Ark.	J. F. Jones	Dry	Clear	37.1
Los Angeles, Cal.	R. C. Hamlin	Good	Windy	35.1
Louisville, Ky.	G. M. Younger	Dry	Cloudy	36.8
Marion, Ind.	M. L. Swayzey	Good	Cold	33.0
Meriden, Conn.	J. F. Miller	Dry	Clear	49.2
Milwaukee, Wis.	Wm. F. Sanger	Fair	Cold, W'dy	51.2
Minneapolis, Minn.	L. A. McKay	Good	Cold	47.8
Moline, Ill.	D. H. Duncan	Fair	Windy	23.1
Montreal, Can.	H. Grothe	Muddy	Rain, W'dy	24.6
Neenah, Wis.	J. F. Stroebel	Dry	Fair	26.3
N. Bedford, Mass.	S. C. Lowe	Good	Windy	33.0
Newark, N. J.	W. L. Mallon	Dry	Cool, Cl'dy	36.5
New Haven, Conn.	Cowles Tolman	Dry		55.0
New York City	Glenn A. Tisdale	Wet	Cold, Rain	35.2
Oil City, Pa.	H. S. Phinny	Sandy	Cold	18.3
Okla. City, Okla.	J. W. Lee	Good	Warm	36.3
Paris, Ky.	C. A. Weber	Fair	Clear	34.0
Pasadena, Cal.	W. P. White	Good	Cold	31.4
Paterson, N. J.	Nicholas Hughes	Good	Cloudy	34.9
Peoria, Ill.	S. K. Hatfield	Good	Clear	34.3
Philadelphia, Pa.	James Sweeten, Jr.	Wet	Cloudy	41.9
Phoenix, Ariz.	George Hageman	Wet	Gale	53.0
Pittsburg, Pa.	W. Murray Carr	Dry	Clear, W'dy	34.2
Plainview, Tex.	John J. Ellerd	Muddy	Clear	21.1
Portland, Me.	H. D. Cushman	Muddy	Rain	24.9
Portland, Ore.	J. C. Braly	Good	Cold	43.8
Providence, R. I.	W. L. Wilcox	Wet	Cloudy	43.8
Putnam, Conn.	O. C. Bosworth	Muddy	Cloudy	29.8
Redlands, Cal.	B. S. Hatfield	Muddy	Rain	26.0
Regina, Sas., Can.	A. O. Store	Good	Gale	33.9
Remington, Ind.	C. B. Johnston	Dry	Fair	25.5
Rochester, N. Y.	G.R. MacCollum	Good	Cold, W'dy	34.5
Rockford, Ill.	L. J. Theiss	Fair	Cold	33.4
Rutland, Vt.	O. H. Coolidge	Muddy	Rain	26.6
Saginaw, Mich.	Fred H. Witters	Dry	Cold	25.1
San Antonio, Tex.	L. F. Birdsong	Dry	Windy	35.6
San Diego, Cal.	W. S. Smith	Muddy	Rain	29.8
San Francisco, Cal	John F. McLain	Good	Gale	36.1
San Jose, Cal.	L. Normandin	Good	Windy	35.6
Saranac L'ke, N.Y.	E. E. Bellows	Wet	Cold	30.3
Scranton, Pa.	O. D. DeWitt	Rough	Cloudy	36.4
Seattle, Wash.	W. A. Wicks	Good	Cloudy	39.3
Sharon, Pa.	C. H. Wiltsie	Dry	Windy	24.4
Shreveport, La.	J. M. Nabors, Jr.	Dry	Clear, W'dy	22.2
Sioux City, Iowa	Thomas Murphy	Soft	Windy	23.5
Sioux Falls, S. D.	Knapp Brown	Good	Cold	41.0
S. Bethlehem, Pa.	L. L. Sterner	Fair	Showers	25.8
Springfield, Mass.	F. G. Jager	Heavy	Cold, W'dy	36.1
Springfield, Mo.	H. E. Seeley	Fair	Clear	26.9
St. Louis, Mo.	J. B. Dryer	Wet	Cold, W'dy	36.9
St. Paul, Minn.	A. H. Clark	Fair	Fair	31.8
Syracuse, N. Y.	C. W. Bull	Fair	Rain	41.7
Toledo, Iowa	Harvey Jones	Heavy	Cold	24.8
Toledo, O.	C. B. Sare	Good	Windy	31.7
Toronto, O., Can.	A. W. Wilson	Good	Cloudy	34.9
Trenton, N. J.	Walter Richards	Bad	Rain	25.8
Utica, N. Y.	W. W. Garabrant	Heavy	Rain	39.3
Vincennes, Ind.	D. D. Aldrich	Poor	Cold, Gale	35.7
Walla Walla, W'sh.	R. H. Tuttle	Muddy	Rain	34.2
Walton, N. Y.	J. R. Bryce	Muddy	Rain	18.8
Washington, D. C.	D. S. Hendrick	Good	Fair	33.8
Waterloo, Iowa	R. H. Cramer	Fair	Cloudy	39.7
Wellsville, N. Y.	Oak Duke	Fair	Cloudy	27.7
West Brooklyn, Ill.	J. W. Thier	Rough	Clear, Cool	35.1
Wheeling, W. Va.	J. J. O'Keefe	Good	Clear	26.2
Williamsport, Pa.	S. A. Courson	Bad	Rain	20.3
Wilkes-Barre, Pa.	W. S. Lee	Sticky	Showers	34.1
Wilmington, Del.	Peter Hanson	Fair	Cloudy	23.1
Worcester, Mass.	F. B. Williams	Muddy	Cold, W'dy	29.7
Youngstown, O.	Jacob Stuhldreher	Good	Clear	27.9

The visiting delegates of associations, some representing several, heard addresses of welcome from city officials and discussions of the need of a protective national body. Tomorrow morning there is to be a jitney ride around the boulevards and the convention will meet again in the afternoon to hear talks by Nelson S. Riley, southwest manager of the Studebaker Corp.; J. F. Martin, manager of the Buick branch, and John T. Smith, secretary of the Missouri State Federation of Labor.

Perry T. Allen, Springfield, Mo., was elected temporary chairman. Mr. Allen is attorney for the teamsters' and chauffeurs' union in that city; it includes the jitney drivers and owners. E. K. Carnes, of Kansas City, is temporary secretary.

The sentiment of the association, as announced by Mr. Carnes, is that the unscrupulous, irresponsible men now in the jitney business should be squelched and that the association should adopt for an emblem a design bearing the words "service, cleanness, courtesy, rapid transit."

Several speakers prophesied that there would be no street car rails in cities within 10 years, that all local, but not interurban transportation would be jitneyized.

L. M. Emlet, Kansas City, spoke as a representative of the Automobile and Auto Bus Owners' National Protective and Benevolent Assn., just organized in Muskogee, Okla. It proposes to indemnify members on a mutual basis at a cost of $60 a year for buses holding up to ten passengers, $72 for ten to sixteen passengers and $84 for sixteen to twenty-two passenger types.

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Pilgrim Organizer Charged with Fraud

DETROIT, MICH., May 4—*Special Telegram*—Clarence H. Leete, one of the organizers of the Pilgrim Motor Car Co., was arrested here today charged with collecting between $5,000 and $15,000 from a large number of local people to whom he had promised employment in the plant which the concern claimed to be starting. Leete, it is said, had the applicants pay as much as $200 and offered to give stock in the company for the amount given by the applicant for a position.

The Pilgrim Company was started last September to build a car designed by W. H. Radford, who resigned, former engineer of the Warren Motor Car Co.

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Puritan Takes Mondex Shock Preventers

DETROIT, MICH., May 4—The Puritan Machine Co., this city, has purchased the stock of Mondex shock preventers heretofore produced by the A. & J. Mfg. Co., Binghamton, N. Y. Dealers and owners will be supplied with parts by the Puritan company.

Review of the Week in Detroit

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Truck Convention the Big Coming Event—Car Factories Breaking Records

DETROIT, MICH., May 4—The truck convention under the auspices of the National Automobile Chamber of Commerce will occupy the attention of a goodly number of Detroit's automobile fraternity this week, not only those who are directly connected with the commercial car end of the automobile business, but many others who see in the discussions and papers subjects of benefit whether they make or sell passenger cars or trucks.

The new Hotel Statler will be the scene of this year's session, and ample accommodations are thereby assured. Already some of the advance guard has arrived, and from present indications this should prove to be the best and most profitable gathering the truck branch of the business ever had. To date over thirty truck concerns have signified their intention of being amply represented.

The committee on arrangements has done its work well, for it has provided recreation as well as a great number of timely subjects for discussion. Most of them deal with the selling end of the business or on topics directly related to selling, the engineering details of truck work being left to the S. A. E., as they should be.

The subject of load ratings will be taken up at length, with H. Kerr Thomas of the Pierce-Arrow company starting the ball rolling. Then there is the much-mooted topic of a truck show, with the debate opened by M. L. Pulcher, of the Federal company. Windsor T. White will take up in detail the subject of time payments on trucks and its limitations.

Production Is Booming

Cadillac has given out a few figures on the production through April of its eight, and they are causing considerable comment. Up to the first of May, the concern had shipped 8,286 cars of the 1915 type, and of this number 2,325, or over a quarter, were turned out in April.

While on the subject of production, the trade has been put in possession of some interesting figures from several of the other plants as well.

The Saxon Motor Co. shipped over 1,800 cars in April, which is three times the output of April, 1914. For the first 4 months of this year, over 6,200 Saxons have left home for all parts of the country, and it is expected that about 3,000 more will go out during this month of May.

In April the King company shipped 576 eights and 180 fours. It was about the middle of January before King was able to make deliveries on its eight, and since then 1,352 of them have been shipped.

The Ford organization built 16,108 more cars in April this year than during the same month the previous year. The total for the month just passed was 46,510, the largest number ever produced in a month.

500,000 Fords in 1916

There is much speculation now as to what the price of the Fords will be for the 1916 fiscal year. Some have it that 500,000 will be turned out, making a price reduction corresponding to the cut of last year possible.

Some day, when Ford gets tired of building assembly plants, it will abandon making complete cars in the parent factory here, but will simply produce parts to be assembled in the territory in which they are sold. While this is merely speculation, it has been voiced several times as an opinion by business men.

Of great interest to the automobile public of Michigan is the bill which passed on April 29 and was signed by Governor Ferris. It is known as the garage lien law, and was fostered by the Detroit garagemen's association. In a word, it gives the garagemen protection for repair work, for they are accorded the right to hold any machine brought in for repairs until such have been paid for.

Clean Up 1915 Outputs

A number of the makers in this vicinity are now engaged in cleaning up their 1915 output preparatory to starting on 1916 models. Several will come out with announcements of new cars along the latter part of the month, and in the early part of June. It is probable that the débuts of new cars will generally be earlier this season than last, for with the usual policy of waiting until one year's output is practically sold before publicly talking of the next, there is no fixed date for anyone. It is believed that the public will see less radical departure from former design in the 1916 models, as now the makers are getting down to almost standard designs, and changes are less pronounced.

Convention visitors, visiting dealers, car demonstrators and all Detroit motorists are deprived of one of the beauty spots of the Automobile City, for the time being at least. Belle Isle, known as one of the country's finest parks, with its miles of beautiful automobile drives, is cut off from the mainland by a disastrous fire which completely destroyed the steel bridge. A temporary vehicle bridge is contemplated, pending the raising of sufficient money to build a new $1,000,000 stone affair.

Cadillac Ships 8,286 Eights

2,325 Cars Turned Out in April, Biggest Month in Company's History

DETROIT, MICH., May 3—Up to and including April 30, 1915, the Cadillac Motor Car Co. has shipped 8,286 of its eight-cylinder cars. The first cars were shipped in October, the production increasing rapidly from only a score a day to more than 125 a day at the present time. During April 2,325 cars were shipped, or an average of ninety a day. It was the biggest month of business in the 10 years the Cadillac company has been incorporated.

Smith Succeeds Thompson as Maxwell Works Manager

DETROIT, MICH., May 1—George W. Smith has succeeded A. Thompson as works manager of the Maxwell Motor Co. He was Mr. Thompson's assistant and previous to coming to the Maxwell company he was works supervisor at the J. I. Case T. M. Co., Racine, Wis.

Pneumatic Control Valveless Car Runs on Acetylene

ELKHART, IND., April 30—Orville Z. Frazier, who invented a valveless engine some time ago, has completed blueprints for a new car, called the Frazier-Elkhart. It is a seven-passenger machine with a six-cylinder valveless motor. Three types of motors are planned, one of 186, one of 90 and one of 60 horsepower. The new machine will have a number of features that are believed to be important improvements. The water in the engine is passed through the piston. It is equipped with an automatic lock clutch. The gears and brakes are controlled on the steering wheel by air. In the transmission all gears run at the same time and are equipped with an internal sliding shaft. The engine is started by depressing a crank at the dash, which starts the dynamo and generates a spark, thus doing away with all storage batteries, dry cells, electric starters and cranks. The fuel used for operating the car is acetylene gas.

Somerville Brings Out Starter

DETROIT, MICH., May 1—W. A. Somerville, former advertising manager of the Rapid Motor Vehicle Co., and the Stromberg Motor Devices Co. has again entered the automobile field with a starter to sell for less than any electric starter on the market. This starter to be known as the Rae is a double unit system with the motor and generator connected on the same shaft. Mr. Somerville has organized the Somerville Special Agency. The Morgan Electric Co. will manufacture the starter either in Detroit or in some of the Michigan and Indiana towns that are trying to secure the factory. A service station will be opened on Woodward avenue. The first starters will be for Ford cars but later it will be made for all makes.

Convertible Bodies Are Standard for 1916 Haynes Line

NEW YORK CITY, May 4—For 1916 the Haynes light six will be equipped with new five- and seven-passenger and roadster bodies, all of which will be convertible for summer or winter service; the winter tops will be supplied at an extra charge. Mechanically there will be no material changes, the 3 1-2 by 5-inch block motor, with Stewart-Warner vacuum fuel feed, dry disk clutch, 34 by 4 tires and other features of the 1915 car being retained.

Hub Builds 2 1-2-Ton Gasoline-Electric Truck

COLUMBUS, O., May 1—The Hub Motor Truck Co., this city, has completed the first model of its gasoline-electric truck and is now preparing to open a factory for their manufacture on an extensive scale. The office of the Hub company has been established in the Terminal building at Third and Rich streets.

L. H. Pierce and O. C. Howard have charge of the designing and manufacture of the truck, which is the first of its kind produced in Columbus.

Electricity generated by a gasoline motor furnishes power to drive the vehicle. The Hub company was incorporated under the laws of Ohio with a capital of $300,000 for the purpose of building and marketing the trucks.

The model completed is a 2 1-2-ton vehicle and is equipped with a 30-horsepower gasoline engine which is sufficient to generate all the electrical current necessary. Trial runs made with a full capacity load on hills and bad roads show the truck's ability as a saver of fuel, consuming only a gallon for every 15 miles traveled. The motors are built in the rear wheels making the connection without transmission, etc.

Hawkins Visits Seattle

SEATTLE, WASH., April 30—N. A. Hawkins, general sales manager of the Ford Motor Co., of Detroit, was a visitor in Seattle this week, inspecting the big assembling factory in this city, which supplies the trade in Washington, Idaho and western Montana. Hawkins was honored guest at the banquet given by the Seattle Chamber of Commerce.

King Ships 45 Eights a Day

Has Turned Out 1,352 Eights —576 Eights and 180 Fours in April

DETROIT, MICH., May 3—The King Motor Car Co. shipped 576 eight-cylinder cars and 180 fours during April. Shipments of the first King eights began about January 15, and since then 1,352 cars of this model have been shipped by the King company.

Production of eights is now at the rate of forty-five a day and this will be increased to seventy-five a day within the next 4 weeks. The total production of 7,000 is expected to be completed during the second half of July. An average of ten to fifteen King fours is now the daily output.

The foreign business of the company has been increasing very rapidly of late. To date 138 eight-cylinders have been shipped to London and an order for 200 more has been received from the same party. Twenty-four were shipped to Manila recently, also sixteen to Russia and lots of three or more to different countries in South America.

$250,000 Ford Plant in Milwaukee

Will Produce 18,000 to 20,000 Cars a Year—To Employ 400 to 500 Men

MILWAUKEE, WIS., May 1—The Ford Motor Co., Detroit, Mich., is about to expend $250,000 or more in the erection and equipment of an assembling plant in Milwaukee which will produce 18,000 to 20,000 complete cars annually and have a pay-roll of $600,000 a year, employing 400 to 500 men. This information, from authoritative sources, is further substantiated by action taken before the Milwaukee common council this week in the direction of special privilege ordinances making possible the construction of this building on a large tract of land adjacent to the Chicago & Northwestern road's main line along the lake shore, and bounded by Prospect avenue and Kenilworth and Windsor places.

According to A. W. L. Gilpin, manager of the Milwaukee Ford branch, it is contemplated to erect a seven-story reinforced concrete factory, 160 x 330 feet in size, costing about $250,000. It will supplant the rather small assembling plant established in Milwaukee about 2 years ago but long ago found wholly inadequate to take care even of the entire Wisconsin demand for Fords.

The plant will be one of 25 which the Ford company is establishing in populated centers throughout the country. By 1916 it is figured that the Wisconsin absorption of Fords will at least equal the annual production of the Milwaukee Ford assembling plant.

MILWAUKEE, WIS., May 3—Construction on the assembling plant of the Ford Motor Co. will be started at once, an ordinance granting the company special privilege to enable it to work doubly fast having been granted by the common council.

Turk Is Inter-State Designer and Production Manager

MUNCIE, IND., May 1—At a special meeting of the directors of the Inter-State Motor Co., owing to a heavy increase in production T. J. Turk, engineer, was appointed designing engineer and production manager for the coming year.

Anderson Succeeds Harris as Hupp Sales Manager

DETROIT, MICH., May 1—Lee Anderson, who some time ago became advertising manager of the Hupp Motor Car Co., has now also assumed the position of sales manager, succeeding Frederick A. Harris, who has resigned.

Ide in Charge of Simms Magneto Detroit Office

EAST ORANGE, N. J., May 3—Jack Ide, formerly sales representative of the New Departure Mfg. Co., has resigned and joined the selling force of the Simms Magneto Co., this city. Mr. Ide will have charge of the Detroit office which has been opened in the Whitney building.

Harry Stoddard, who has been representing the Simms Magneto Co. in Detroit, has been transferred to the home office here and is now in charge of the sales department.

Superior Motor Specialty to Move to New York

PHILADELPHIA, PA., May 3—To better care for its increasing business, the Superior Motor Specialty Co., maker of spark plugs for double ignition, will remove May 10 from its present location at 44 N. Fourth street, this city, to 30 Irving place, New York City.

Elwood Joins Marmon Sales Force

INDIANAPOLIS, IND., May 3—A. L. Elwood, former manager of the St. Louis, Mo., branch of the Locomobile company and more recently sales manager of the Chicago branch of the same concern, has joined the sales force of the Nordyke & Marmon Co. Mr. Elwood will do territorial work in connection with Marmon agents.

Stearns Production Gains 55%

Factory Is Running at Full Capacity Night and Day —Men Scarce

CLEVELAND, O., May 1—The F. B. Stearns Co. is enjoying a period of unequalled prosperity this season. The factory is running night and day with a full force, yet needs more men than it has been able to get. The company has been advertising in half a dozen cities for machinists. It is paying time and one-third on its night shift. Production in March was 55 per cent. greater than during March last year, in April 70 per cent. greater, and if all signs do not fail will go 100 per cent. over the corresponding period a year ago in May.

Woodruff To Go Abroad on War Contract Work

CONNERSVILLE, IND., May 3—In response to increasingly numerous inquiries from abroad, A. A. Woodruff, commercial manager of the Lexington-Howard Co., this city, expects to sail for Europe on May 8 on war contracts and export business. Mr. Woodruff expects to remain abroad not over 5 weeks as the company's factory is said to be operating at double capacity and to be turning out twice as many cars as at any time in its history.

Record Order for Davis Eights

Company to Supply 250 Motors for Railway Coaches for 5 Years

MILWAUKEE, WIS., May 1—The Davis Mfg. Co., a large manufacturer of gasoline motors for heavy duty vehicles of all kinds, has closed an order for practically the entire construction of an average of 125 gasoline-propelled passenger coaches for a period of 5 years for the Railway Engineering & Equipment Co., an organization which has recently embarked in the business of manufacturing self-propelled railway coaches for the use of steam and electric railways on short hauls, connecting lines, in cities and elsewhere to cut operation costs, facilitate traffic and economize on the use of expensive steam or electric equipment.

The Davis company has completed a model coach for the Indiana concern, and a party of officials arrived in Milwaukee last week in the car to close the contract and make local demonstrations. The party included General Manager A. R. Burkdoll, Chief Engineer W. D. Worth and other officers.

The contract has been in view for more than a year, and in anticipation thereof the Davis company selected a site and broke ground for a large new plant in West Allis, the manufacturing suburb of Milwaukee, about 10 months ago. The work was carried on slowly until early this week, when orders were issued to complete the plant immediately. It will be devoted largely to the new industry.

Each coach is propelled by two eight-cylinder gasoline engines through double friction drive applied to every wheel. The passenger capacity is 100 and the cost complete is $20,000. The cost of operation is approximately 5 cents per mile, placing the new coach in the jitney bus class, so far as operation cost is concerned. The first year's requirements will be about forty and the fifth year's 300. The coach work will probably be done in Milwaukee, so that the entire car will be a Milwaukee product.

The Davis company manufactures motors for several large pleasure car and truck builders of America, and exports a great many motors annually. The present plant in the Menomonee valley will not be abandoned when the new West Allis works are opened, being needed to supply a miscellaneous demand for Davis motors.

Holdaway Smooth-Tread, Non-Skid Tire Enters Field

LOS ANGELES, CAL., April 23—The Holdaway Tire Co., is the latest addition to the manufacturing ranks of Los Angeles. The new Los Angeles-made tire is claimed to be the only smooth-tread, non-skid tire on the market. The inventor conceived the idea of inserting small fabric plugs into the tire in such a manner as to keep the tread smooth and at the same time prevent the car from skidding. In the tests the Holdaway tire proved a success and the retail branch is now doing a prosperous business.

Mead Goes to Cheltenham Advertising Agency

NEWARK, N. J., May 3—C. L. Mead for several years advertising manager of the Lovell-McConnell Mfg. Co., this city, has resigned to join the forces of the Cheltenham Advertising Agency, New York City. Mr. Mead's successor has not yet been appointed.

Schwalbach Leaves Bearings Co. of America June 1

NEW YORK CITY, May 3—Alex Schwalbach leaves the Bearings Co. of America on June 1. For 6 years he has been advertising and publicity man for the F. & S. bearings imported by the former, J. S. Bretz Co., and its successor, the Bearings Co. of America.

Business Methods Adopted by Detroit S. A. E.—Dunham Chairman

Section Is Placed on Sound Financial Basis—Paid Secretary in Charge—Paper by A. P. Brush on Scientific Chassis—Birdsall Honored—Record Attendance

DETROIT, April 29—The Detroit section of the Society of Automobile Engineers is at last being placed on a sound financial basis with a paid assistant secretary to be in charge, a condition made necessary because of the rapid growth of the section, which naturally should be the largest in the country. The financing of this move is being taken care of by voluntary subscriptions from Detroit manufacturers and other concerns with branches in this city. Already $600 has been pledged and approximately $2,500 will be needed.

This new plan of conducting the section was made public to-night at the regular monthly meeting, at which over fifty attended, the largest meeting of the year. The attendance was largely due to the presenting of a very illuminating paper by A. P. Brush, consulting engineer, on scientific chassis engineering, and also due to the fact that it was the annual election of the section.

The officers, all of whom were unanimously elected, are: George W. Dunham, chairman; J. G. Vincent, vice-chairman; Fred J. Fisher, treasurer; W. H. Conant, secretary; George M. Holley, executive member, and K. W. Zimmerschied, member of the national nominating committee.

During the 4 years of the existence of the Detroit section, E. T. Birdsall has presided. He has been the first and only chairman, and on this, the occasion of his retirement, he was presented with a silver cigarette case, suitably inscribed.

A complete report of Mr. Brush's paper appears on pages 802-805 of this issue.

Metropolitan S. A. E. to Discuss Governing at May Meeting

NEW YORK CITY, May 4—At the regular May meeting of the Metropolitan Section of the Society of Automobile Engineers the evening will be given over to the subject of speed governing. There will be two papers, one by Theodore Douglas, president of the Duplex Engine Governing Co., entitled Governing Truck Speed and the other on Governing the Speed of Internal Combustion Engines, by Frank Trego, chief engineer of the Knox company. The governing committee is also making an endeavor to secure a preliminary report of the work of the Research Committee on governors. The meeting will be held at the Automobile Club of America in this city from 8.30 to 10.30 p. m. A number of firms building trucks with governors have been asked to send representatives.

Keegan Is Briggs & Stratton Sales Manager

CHICAGO, ILL., May 3—J. F. Keegan, for several years secretary of the Fulton-McCutchan Co., this city, has resigned to become a sales manager of the Briggs & Stratton Co., Milwaukee, Wis. Mr. Keegan assumed his new duties May 1.

New Era Engineering Co. Incorporated to Manufacture Automobiles

JOLIET, ILL., April 30—The New Era Engineering Co. has incorporated with a capital of $30,000, the incorporating commissioners being M. M. Case, A. S. Golding and Oscar Blaess.

Manufacture, assembly and sale of automobiles, motors and all the parts and accessories of the same, is the object of the concern.

Detroit Violators Warned by Tag

Police Notify Culprits of Traffic Ordinance Violated as Indicated on Card

DETROIT, MICH., April 29—In its effort to further improve traffic conditions, the Detroit police department has issued red tags to be carried by those patrolmen whose duty it is to specially look after the observation of the traffic ordinance by automobilists.

The tag bears the following heading: "You are violating the traffic ordinance as indicated by the check-mark below. This notifies you to have the same corrected within 48 hours or complaint will be made in court." Then follows a list of twenty-nine violations which are the ones, according to the police department, which occur most frequently.

In front of each of the enumerated violations there is a blank space and when the patrolman finds a car which is violating the rules he checks or makes a mark opposite the violation enumerated in the list. Then the tag is attached to the offender's car and the patrolman records in his note-book the license number of the car and the nature of the violation. A few days later he or some other traffic man investigates the cases they have noted in their note-books or reports and in case the recorded violation has not been corrected then the matter is reported to the court for further action.

In addition to the tags the police department has also issued a summarized pocket book edition of the new local street traffic ordinance which became a law March 1, 1915. The same summarized rules have also been printed on a large card or tag to be hung in garages, show rooms and offices. Following is a reproduction of the policemen's red tag:

DETROIT POLICE DEPARTMENT.

YOU ARE VIOLATING the traffic ordinance as indicated by the check-mark below. This notifies you to have the same corrected within 48 hours or complaint will be made in court.

.....No tail light.
.....White light does not shine on rear license tag.
.....Tail light out.
.....Tail light dirty.
.....Tail light lens broken.
.....Tail light defective.
.....Headlights glaring.
.....No license tag (front or rear).
.....License tag mutilated or defaced.
.....License tag obscured or dirty.
.....License tag swings.
.....No side lights.
.....Side lights out.
.....Side lights dirty.
.....Side light lens broken.
.....Side light defective.
.....Side light obscured.
.....No horn or other device for signal.
.....Device for signal inadequate.
.....Muffler cut-out control in wrong place. (Ord. 170-A., Sec. 6.)
.....Not properly parked, should be parallel.
.....Not properly parked, should be at an angle.
.....Parked in safety zone.
.....Parked within 75 feet of intersection where street car stops.
.....Parked on cross walk.
.....Parked within less than 15 feet of fire hydrant.
.....Parked over 1 hour limit.
.....Motor running when left unattended.
.....Controller switch not locked and key not withdrawn.

Apply at any police station for summary of traffic ordinance.

DETROIT POLICE DEPARTMENT.

Boston to Have Truck Show Next March

BOSTON, MASS., May 4—The annual meeting of the Boston Commercial Vehicle Dealers' Assn. was held today, and it was voted to cooperate again with the Boston Automobile Dealers' Assn., and to have a show in March, by taking a section of Mechanic's building at the same time as the passenger car show. The election of officers resulted as follows: Josiah S. Hathaway, White, president; James W. Maguire, Pierce-Arrow, vice-president; Day Baker, General Vehicle Co., treasurer; Chester I. Campbell, secretary. The above officers together with the following comprise the board of directors: P. S. Altman, Kelley-Springfield; C. P. Rockwell, Jeffery; Norman Halliday, International Motors; John L. McCone, Overland, and John H. MacAlman, Stearns. With the exception of Mr. McCone, all were re-elections.

May Raise Pa. Fees 50 Per Cent.

Success for Federation's Fight —Fees Too High Already —Bill May Not Pass

HARRISBURG, PA., May —The effort of Governor Brumbaugh and the administration forces to double the automobile license fees in Pennsylvania has been met with a storm of protest from motorists throughout the state and the Pennsylvania Motor Federation has carried on a splendid fight that promises to end in success.

At a hearing the motorists showed that in some cases the increased license fees would amount to a 5 per cent. tax, and they also pointed out that the motor clubs affiliated with the Motor Federation had during the past few years spent hundreds of thousands of dollars on road repair and that the federation bore the greater part of the expense in the effort to pass the $50,000,000 loan for road improvements a year ago.

The committee offered a compromise of a 50 per cent. raise on passenger vehicles and to leave the fees doubled on commercial vehicles. The campaign of publicity conducted by the federation has shown that 80 per cent. of the truck traffic is confined to corporate limits and that the great proportion of the trucks do not reach the state roads.

The bill came out of committee with a general raise of 50 per cent. in all classes of fees and the exemption from license fees of motor vehicles owned or operated by charitable institutions.

The following table shows the present and proposed fees:

PNEUMATIC TIRE CARS AND TRUCKS

Horsepower	Proposed	Present
Under 20	$7.50	$5
From 20 to 35	15.00	10
35 to 50	22.50	15
Over 50	30.00	20

FOR SOLID TIRE MOTOR VEHICLES

Pounds	Proposed	Present
Under 4,000	$7.50	$5
4,000 to 5,000	15.00	10
5,000 to 10,000	22.50	15
10,000 to 15,000	30.00	20
15,000 to 24,000	37.50	25

Leading members of the House of Representatives now admit that the bill has little chance to pass in its present form, and unless a compromise satisfactory to the automobile associations is made the fees will remain as at present.

The federation made every effort to put through a light bill that would have required all vehicles to carry lights to show from front and rear, but the country members objected to having lights on farm wagons, and the bills were defeated.

The Stern bill requiring automobiles to be equipped with fenders was defeated in the house this week. The bill received only 16 votes, 108 being cast against it. The Jones jitney "regulator" was also stricken from the house calendar. The measure would have made it necessary for owners of jitney buses to file a $2,500 bond with the state and pay 2½ per cent. of the gross receipts to the municipality in which the cars were operated. The measure was the most drastic of the several jitney bills introduced in the legislature.

A bill creating a department of motor vehicles with a commissioner at a salary of $4,000 a year has been introduced in the senate by Senator Beidleman, of Dauphin county. The bill is designed to take from the highway department the administration of all laws relating to motor vehicles and giving the new department control of all such laws. The bill creates a chief inspector and assistant inspectors not to exceed 10 and not more than 30 examiners to examine applicants for automobile licenses.

Connecticut Boosts Truck Fees

5-Ton Truck to Cost $75—Cheapest Is $11—Lights on All Vehicles

HARTFORD, CONN., May 3—Connecticut's amended automobile bill having passed the Senate this week is now before Governor Holcomb for his signature, which is expected the first of the week. The bill provides for about the same law as has heretofore existed, with the possible exception of truck fees. These have been considerably increased. Under the new law a 5-ton truck will cost $75, the lowest truck license costing $11. Another feature is the doing away with livery licenses which have been much in demand heretofore because of the low fee. Hereafter livery cars will carry individual numbers the same as private cars. This hits at the individual who in no sense was entitled to a livery license but had one because he could get it cheap. However, the real sting comes on the legitimate livery man and where a number of cars are used the fee will come rather high. No more operator's numbers are to appear above the dealers' license plates. Another feature that has made a favorable impression is that an officer desiring to make an arrest must display his badge of office on the outside of his outer garment.

Dazzling headlight ordinances now in force in the several cities and towns of the state may become inoperative. All vehicles must carry lights, in cities as well as in towns. This feature is especially agreeable to automobilists.

Can Stay 10 Days in R. I.

New Regulation Fair to Non-Residents—Fail to Boost License Fees

PROVIDENCE, R. I., May 1—The Rhode Island legislators have evacuated the capitol and gone to their homes with the 1915 session at an end. And they have not left much of a mark in the way of motor legislation after them. Not that they did not intend to do something, but things went from bad to worse with them this year. There was a bill introduced again to increase the fees very materially. But it rested in committee until it was too late to have a public hearing on it. Not to have the hearing would have been illegal. And the motor organizations were primed to fight it, so the bill died.

The most important change relates to non-residents, and Rhode Island, the first state to put in the notoriously unfair 10 days' clause, has seen the error of her ways and now has a favorable clause. This is due to the holding up of Rhode Islanders by Massachusetts officers in retaliation against Rhode Island officials. The new clause provides that any motorist from another state may go there as often as he wishes provided he does not stay more than 10 consecutive days at a time. He may go 9 and return for 9 more. It also provides that if a resident of another state engages in business in Rhode Island he must register.

The legislature increased the appropriation for the automobile department to $12,500, and it passed a jitney bill calling for $500 per passenger of the vehicle's capacity, with cities and towns making regulations for licenses, speed, stops, etc.

The big problem of highways was left untouched, due to politics and failure to reach a compromise, so that the roads of the state will be left in very poor condition.

Michigan Garage Lien Bill Is Now a Law

DETROIT, MICH., May 4—The Michigan garage lien bill which is fostered by the Detroit Garage and Station Operators Assn. has unanimously passed both houses of the Michigan legislature April 29 and was signed by the governor. It becomes effective in 90 days. It provides the garage man with a very effective weapon in that he automatically obtains a lien on any vehicle on which work is done, until charges for the work are paid. Heretofore, garagemen have had to look to the individuals for payment rather than having the car as security.

To Auction Part of New Columbus Buggy Company May 12 and 13

Manufacture of Vehicles Will Be Discontinued and Even Trade Names Will Be Sold—To Continue Supplying Parts to Owners of Company's Cars

COLUMBUS, O., May 3—Announcement is made by C. A. Finnegan, president, and Eugene D. Hofeller, secretary, of the New Columbus Buggy Co., that a large portion of the business, including equipment, raw materials, and finished products will be disposed of at public auction at the plant on Dublin avenue, May 12 and 13.

The property to be sold has an estimated valuation of $300,000. There are said to be several prospective tenants for the buildings under the new plan.

The company will continue to make and market parts and accessories for the automobiles which were manufactured by the company, which includes the Columbus electric and the Firestone-Columbus gasoline cars. There are between 7,000 and 8,000 of the cars made by the company in use and it is planned to continue to supply parts to these owners. This part of the business, together with materials on hand, is estimated at $100,000. The machine shop where the parts are made will be retained by the company.

Neither automobiles nor horse-drawn vehicles will be manufactured in the future. At the auction the thirty-five electrics, fifteen gasoline cars and a number of second-hand cars will be sold to the highest bidders. Parts for the manufacture of 500 buggies will also be sold. The company will also dispose of all lumber on hand and all equipment for the manufacture of automobiles. This includes fifty separate motors. The estimated value of the machinery is $75,000. The sale will also include the right to use the names, Columbus electric and Firestone-Columbus.

The buildings, outside of the machine shop, will be converted into power buildings with 250,000 square feet of floor-space. One of the smaller buildings has already been leased.

Messrs. Finnegan and Hofeller, who are also owners of the companies making the Thomas and the Buffalo Electric at Buffalo, have converted the Thomas plant into power buildings with considerable success. They say that later on the Buffalo factories may be moved to the Columbus plant.

L. M. Browne, who has been with the Columbus Buggy Company for a number of years, will remain as superintendent of the buildings and in charge of the parts manufacture. The plant will be open for inspection after May 5.

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Gasoline 14 Cents in Denver

DENVER, COLO., April 28—Fourteen cents a gallon is the gasoline price now being made by all the filling stations in Denver. The garages, however, are still charging 1 to 3 cents higher than this price as a rule, on the ground that they regard the gasoline trade largely as a side line and cannot afford to bother with it for small profit. This is the first time since January, 1912, that the retail price of gasoline in Denver has been as low as 14 cents.

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Texas Refiners Boost Gasoline Price

AUSTIN, TEX., April 30—Notwithstanding the increase of production of high-grade crude petroleum, due to the development of the new Thrall field, 35 miles north of here, the refining companies of Texas have begun boosting the price of gasoline. For many months the ruling price of the fuel has been 10 cents per gallon in all parts of this state. A few days ago the Magnolia Petroleum Co. increased the price to 12 cents, and other companies followed suit. It is hinted that the price may go several cents higher in the near future. In explanation of the 2-cent raise per gallon E. P. Angus, of Dallas, representing the Magnolia Petroleum Co., said:

"Gasoline has been sold in Texas during the last 8 or 10 months at an unreasonably low price, 10 cents a gallon. The advance made is only 1 cent to garages and dealers, who take the bulk of gasoline sold, and 2 cents to consumers.

"Even in Oklahoma, the state where more oil is produced than in any other one state, the ruling price during the same period was 12 cents to garages and dealers and 14 cents to consumers, with a variation of perhaps 1 cent less or 1 cent to 2 cents more, dependent upon competitive conditions of extra freight costs.

"During the same period the price of gasoline in bulk on shipboard at Texas ports has been from 6½ to 8 cents a gallon. To any bulk price at seaboard must be added at least 4 cents a gallon as a marketing expense, 1 6-10 cents a gallon as freight cost, and a reasonable amount as profit to the marketing department. It will be seen by an analysis of these figures that the price of gasoline in Texas has been unreasonably low, and, therefore, when the price was advanced by our competitors we met it."

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Market Prices Steadier

NEW YORK CITY, May 3—Market prices this week were steadier. The drop of lead to $4.15; the closing of tin at $41, and the rise of antimony to 32 cents, were the most important changes during the week. Electrolytic copper continued quiet and less firm in the domestic market. Temporarily, the demand from domestic consumers is light and there are few export inquiries for unwrought copper. During April the total copper exports were 16,822 tons, making the total exports since the first of January this year, 88,746 tons. There was no change of consequence in the crude rubber market last week. Reports in regard to the condition of trade in various rubber goods continue favorable. Manufacturers, however, continue to purchase sparingly.

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Goodyear Capital May Be Increased $10,000,000

AKRON, O., May 3—The Goodyear Tire & Rubber Co., it is expected, will make a large increase in authorized capital stock. This is now $7,000,000 preferred and $8,000,000 common, all issued, and

Daily Market Reports for the Past Week

Material.	Tues.	Wed.	Thurs.	Fri.	Sat.	Mon.	Week's Changes
Antimony	.27½	.23	.29	.29	.30	.32	+.04½
Beams & Channels, 100 lbs	1.31	1.31	1.31	1.31	1.31	1.31	.....
Bessemer Steel, ton	19.00	19.00	19.00	19.60	19.00	19.00	.....
Copper, Elec., lb	.18½	.18½	.18¾	.18⅝	.18⅝	.18⅝	+.00⅛
Copper, Lake, lb	.19	.19	.19	.19	.19	.19	.....
Cottonseed Oil, bbl	6.58	6.56	6.52	6.60	6.62	6.61	+.03
Cyanide Potash, lb	.21	.21	.21	.21	.21	.23	+.02
Fish Oil, Menhaden, Brown	.41	.41	.41	.41	.41	.41	.....
Gasoline, Auto, bbl	.12	.12	.12	.12	.12	.12	.....
Lard Oil, prime	.90	.90	.90	.90	.90	.90	.....
Lead, 100 lbs	4.20	4.15	4.15	4.15	4.15	4.15	—.05
Linseed Oil	.64	.64	.64	.64	.64	.65	+.01
Open-Hearth Steel, ton	19.00	19.00	19.00	19.00	19.00	19.00	.....
Petroleum, bbl., Kans., crude	.40	.40	.40	.40	.40	.40	.....
Petroleum, bbl., Pa., crude	1.35	1.35	1.35	1.35	1.35	1.35	.....
Rapeseed Oil, refined	..	..	.82	.82	.82	.82	.....
Rubber, Fine Up-River, Para	.60	.60	.60	.60	.60	.60	.....
Silk, raw, Ital	3.90	..	3.90	..	..	3.90	.....
Silk, raw, Japan	3.50	..	3.50	..	..	3.52½	+.02½
Sulphuric Acid, 60 Baume	.90	.90	.90	.90	.90	.90	.....
Tin, 100 lb	42.00	40.00	39.50	39.50	39.00	41.00	—1.00
Tire Scrap	.04¾	.04¾	.04¾	.04¾	.04¾	.04¾	.....

current report has it that the authorized common will so be increased as to make the total of both kinds $25,000,000.

The company will hold a stockholder's meeting June 1 to arrange for taking more young partners into the company. For several years the company has selected from among its most progressive employees in various departments these young men whom it permits to purchase stock on an easy payment plan. The custom has been to sell the stock on a 5-year basis, letting dividends, etc., accumulate on the stock and taking payments from the partners until the end of the period at which a settlement is made and the stock turned over to the purchaser. Owing to the fact that the company has no stock to distribute among this year's young partners it is necessary to vote an increase in the common stock, which matter will be taken up June 1.

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Boston Dealers Accept Used Car Central Market Report

BOSTON, MASS., May 1—The Boston automobile dealers, at least those who are members of the dealers' association, have accepted the Used Car Market Report. The payment will be made from the funds in the treasury, and the service will be furnished free to all the members. In other words there is not a unanimity of opinion regarding the value of the service as some of the members have a feeling that others may not state the true facts in every transaction as to what the actual value each sale represented to the firm.

Tire Stocks Feature of Market

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Studebaker Leads Activity in Car Securities—Many Fluctuations on Rumors

NEW YORK CITY, May 1—Tire issues were the most prominent in this week's securities quotations. The automobile shares were in fair demand, however, with Studebaker, on the expectation of a 5 per cent. dividend on the common stock, a leader both in activity and strength. Goodyear common showed the largest gain of the week, that of 23 points. It is stated that the Goodyear stockholders will probably be asked to authorize a capital increase to $25,000,000. It is also stated that no increase in the preferred is contemplated. The new common stock will be held in the treasury and used for the future needs of the company. It was stated also that the company has already made provisions for the retirement of $350,000 of the preferred, thus anticipating the 1915 requirements in that respect. There was a quiet accumulation of Goodrich stock, and the basis of it was the expectation that the earnings for the first half of the year would be high.

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Bauer Returns from West

DETROIT, MICH., May 1—Howard A. Bauer, formerly assistant sales manager of the Oakland Motor Car Co. and now assistant sales manager of Apperson Bros. Automobile Co., Kokomo, Ind., has returned from an extensive tour through the west with an itinerary that included Salt Lake, Denver, Omaha, Davenport, Des Moines, Minneapolis, St. Paul and Kansas City. Mr. Bauer found the situation had improved greatly at all of these places and he was able to verify statements that the season was above normal.

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Kelly-Springfield to Share Profits Over $1,000,000

NEW YORK CITY, May 3—At the annual meeting of the Kelly-Springfield Tire Co., today, the directors were re-elected. They are: Van A. Cartmell, F. A. Seaman, Austin Poole, Stephen Peabody, Gustave Maas, A. J. Scheuer, and J. Oppenheim.

A resolution was passed authorizing the setting aside of a fund for distribution among the officers and employees in a profit-sharing plan, providing that 10 per cent. of the net profits above $1,000,000 be used in the fund.

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Argo, Hollier Eight and Detroit Electric in England

DETROIT, MICH., May 6—Guy Lewin, the British dealer who was in this country a couple of months ago, has been again in Detroit seeking to place orders for a number of trucks for the French government. While negotiations for these contracts were in progress he filled in his time by taking up the Hollier eight, the Argo and the Anderson electric, as new British agencies.

Automobile Securities Quotations on New York and Detroit Exchanges

	1914 Bid	1914 Asked	1915 Bid	1915 Asked	Wk's Ch'ges
Ajax-Grieb Rubber Co. com	245	..	285	..	..
Ajax-Grieb Rubber Co. pfd	98	102	100	..	..
Aluminum Castings pfd	98	100	98	100	..
J. I. Case pfd	80½	82½	80	87	..
Chalmers Motor Co. com	80	82	90	95	—3
Chalmers Motor Co. pfd	90	92	95	97	+3
Electric Storage Battery Co	52	52½	52	54	..
Firestone Tire & Rubber Co. com	283	288	465	..	+10
Firestone Tire & Rubber Co. pfd	108	109½	110	112½	..
General Motors Co. com	77½	78½	143	145	—2
General Motors Co. pfd	91	92	101	100	+ ½
B. F. Goodrich Co. com	26	27	50	52	+2
B. F. Goodrich Co. pfd	88	89½	102	102½	+1
Goodyear Tire & Rubber Co. com	168	172	262	..	+23
Goodyear Tire & Rubber Co. pfd	94	95½	104½	105	+ ½
Gray & Davis, Inc., pfd	90	97	..	..	..
International Motor Co. com	..	5	13½	14½	—2¼
International Motor Co. pfd	..	15	29	32	—2½
Kelly-Springfield Tire Co. com	..	..	135	137	+5
Kelly-Springfield Tire Co. 1st pfd	..	..	83	86	—1
Kelly-Springfield Tire Co. 2d pfd	..	..	130	140	..
Maxwell Motor Co. com	8	8½	52	53	+3
Maxwell Motor Co. 1st pfd	35½	36½	84	86	+2½
Maxwell Motor Co. 2nd pfd	12¼	12¾	40	42	+2
Miller Rubber Co. com	..	..	180	189	..
Miller Rubber Co. pfd	..	..	104	106	..
New Departure Mfg. Co. com	123	124	137	138	..
New Departure Mfg. Co. pfd	105½	107	106	110	..
Packard Motor Car Co. com	103	..	105	115	+4
Packard Motor Car Co. pfd	94	98	99	..	+2
Peerless Motor Car Co. com	18	25	20	22	..
Peerless Motor Car Co. pfd	..	70	..	55	..
Portage Rubber Co. com	..	30	35	38	..
Portage Rubber Co. pfd	..	85	85	88	..
*Reo Motor Truck Co	8¾	9¼	14½	15½	— ¼
*Reo Motor Car Co	20¾	21¼	32	33	— ¾
Splitdorf Electric Co. pfd	40	50	..	..	..
Stewart-Warner Speed. Corp. com	47	50	69½	71½	+2½
Stewart-Warner Speed. Corp. pfd	99	100	103	105	+1
Studebaker Corporation com	32¼	33	76	78	+10
Studebaker Corporation pfd	83	86	101	103	+1
Swinehart Tire & Rubber Co	62	66	81	90	+1
Texas Company	143½	145	137	139	..
U. S. Rubber Co. com	55	56	70	71	+1
U. S. Rubber Co. pfd	100½	101	108	109	+1½
Vacuum Oil Company	228	231	216	218	+7
White Company pfd	97	100	103	108	..
Willys-Overland Co. com	60	62	116	118	—2
Willys-Overland Co. pfd	88	90	100	102	— ½

OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	1914 Bid	1914 Asked	1915 Bid	1915 Asked	Wk's Ch'ges
Chalmers Motor Co. com	80	85	93	94½	+ ½
Chalmers Motor Co. pfd	90½	93	95	97	—1
Continental Motor Co. com	150	..	..	185	—2½
Continental Motor Co. pfd	..	80	82	85½	..
General Motors Co. com	79	81	143	144½	—1½
General Motors Co. pfd	91½	93	100	102	..
Maxwell Motor Co. com	8⅞	9½	52½	54½	+5½
Maxwell Motor Co. 1st pfd	39	40½	84	86	+3
Maxwell Motor Co. 2nd pfd	14½	15½	40½	42½	+3½
Packard Motor Car Co. com	103	..	..	..	..
Packard Motor Car Co. pfd	94	98	95	..	—4
*Reo Motor Car Co	22	22¾	..	32¾	— ¾
*Reo Motor Truck Co	8⅞	9½	14⅞	15½	+ ½
Studebaker Corp. com	..	..	77½	79½	+11½
Studebaker Corp. pfd	..	..	101	103	+2

INACTIVE STOCKS

*Atlas Drop Forge Co	..	21	..	26	..
Ford Motor Co. of Canada	..	560	700	..	+100
Kelsey Wheel Co	..	195	195	..	..
*W. K. Prudden Co	..	21	19¼	19½	—1½
Regal Motor Car Co. pfd	..	35	14	20	+2

BONDS

General Motors, notes 6s, 1915	101	102	..	..	..
Packard Motor Co. 5s, 1916	95	98½	98¼	..	..

*Par value $10; all others $100 par value.

Twin-City Speedway Under Way

2-Mile Track to Be Completed September 1—Designed for Speed of 110 M. P. H.

MINNEAPOLIS, MINN., May 1—Work is well under way on the new Twin-City speedway. Engineers have staked out the tract and the track and today contractors are estimating bids for the grading. Work is to begin at once and it is expected to complete the job by September 1. The track will cost $750,000. It is to lie at an angle from the north and south line to conform to topography in such a way that a hill protects the drivers' faces from the sun in the late afternoon.

Plans under way will call for a 2-mile oval concrete track. It is to be practically level at the inside and so banked on the turns of the oval that a speed of 110 miles there will be possible. The gradient at the turns is not yet determined. The track will be properly tiled and sewered so that racing can begin almost as soon as a rain ends. The width is 80 feet and the safety zone will be 40 feet. A 9-foot board fence painted white will surround the grounds. Every eighth mile a post will be placed as a marker.

The site is 360 acres of land just south of the city limits of Minneapolis and adjoining the Fort Snelling government reserve.

The Twin City Motor Speedway Co. of Minnesota has been incorporated at $1,000,000. It has been financed and no stock is for sale. F. H. Wheeler, of Indianapolis, is understood to have taken one-third the stock, and St. Paul men who are on the official list the bulk of the remainder. Dr. Dutton has some stock.

Officers are as follows: President, F. H. Wheeler; vice-president, H. E. L. Habighorst of St. Paul; treasurer, C. W. Van Orsdol of St. Paul; secretary and manager, Dr. C. E. Dutton; additional directors, J. F. Sperry, of St. Paul; Orin O. Kellogg, of Minneapolis, and D. F. Wheeler, of Indianapolis.

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Chevrolet Stars in 5-Mile Events at Newark Race Meet

NEWARK, N. J., May 3—Automobile racing was revived in Newark yesterday at Olympic Park, when the Matty Matthews Auto Racing Assn., Inc., under the sanction of the A. A. A. staged a series of 5-mile events on the 1-2-mile dirt track.

Though no records were broken, the times made were fair, considering the condition of the track. In the time trials, 1-mile, free-for-all, G. C. Jessop, New York City, in a Chevrolet, negotiated the distance in 1 minute 13 1-5 seconds, with Joe Dickinson, in a Dickinson Special, second, his time being 1 minute 18 seconds.

Jessop's Chevrolet also won the 5-mile, Class E, non-stock event for cars under 300 inches piston displacement with Grover Bergdoll in an Erwin 40, second. Jessop's time was 6 minutes 28 2-5 seconds.

Willie Haupt in an Erwin Special, won the 5-mile handicap, free-for-all, Class E, non-stock event, in 6 minutes and 37 1-5 seconds. Bergdoll's Erwin came in second with Watson's Mercer third.

The attendance was about 2,500. The next race meet will be held on Decoration Day afternoon.

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Galesburg Race Meet Plans Complete—$3,000 in Prizes

GALESBURG, ILL., May 3—The Galesburg District Fair Assn. has fully completed arrangements for its automobile race meet on June 9. A 100-mile race will be held instead of the 200-mile event. J. G. DeLong, of Chicago, will direct the contest. F. J. Wagner will be the starter.

The purse will be $3,000, divided as follows: first, $1,200; second, $800; third, $500; fourth, $300; and fifth, $200.

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Marmon Starts 75 Times on High

Model 41 Makes 12.17 M. P. G. in Dense Traffic and 16.07 on Clear Road

NEW YORK CITY, May 3—A certified high-gear-in-traffic and economy test has been made by The Automobile Club of America by model 6-41, Marmon car. F. G. Carie, secretary of the Marmon New York Co., Inc., for which concern the test was made, and a sworn statement filed with the Automobile Club of America states that the car was a stock model in all particulars.

Two runs were made to determine the maximum mileage of the car with 1 gallon of gasoline. The first of these was through a route in the city selected for the heaviness of traffic and included the most densely crowded thoroughfares. The second was on an uninterrupted level course over the Coney Island boulevard. In both these tests the car was not taken out of high gear at any time and in fact during the traffic test was sealed in high gear although approximately seventy-five starts and stops were made. At the end of the traffic test the odometer showed 12.8 miles which, after correction, gave a reading of 12.17 miles and at the end of the second test on the clear road, the distance covered after the odometer had been calibrated was 16.07 miles.

Before starting the traffic test the gear lever was sealed on high and the seal was not broken until this test was completed. The car was therefore always started on high gear and in the language of the observer, Ferdinand Jehle, the clutch was not slipped in the ordinary understanding of the term. The speed was maintained at 18 miles per hour as near as possible, although traffic often interfered.

After the completion of the traffic test, the Coney Island run was immediately made with the results above stated. A test of the starting system was made by stopping the motor, letting the clutch in with the gear lever in high. The car was then started with the cranking motor.

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Tacoma Speedway Nears Completion

TACOMA, WASH., April 27—Tacoma's new planked speedway is now half completed. For the entire length the track will be 50 feet wide. This is twice the width it was in some parts last year. The great curves look like the sides of a bowl, their elevation reaching 18 feet.

Plank tracks throughout the country are in abundance, but never before has the Tacoma plan, in which the 2 by 4 boards are laid a half-inch apart, on their sides been tried. Gravel is being shoved into the interstices, and the asphaltum oil is expected to take hold of this and make the track so fast that all world records for speed will be broken. Douglas fir has been used exclusively on the track. About 2,000,000 board feet will go into the course.

In addition to the work being done on the Speedway proper there has been made a complete re-arrangement of the parking spaces. The wood track will prevent a large amount of dust which troubled last year, and oats have been planted in the field adjoining the track where pleasure machines raised great clouds of dirt before. Two large bridges have been constructed crossing the track, making four entrances for automobiles to the inside field. Only one row for parked automobiles is provided by the new plans. This is within 25 feet of the track and behind the pits. There will be space for 108 automobiles.

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Cooper Heads Maxwell Retail Sales

DETROIT, MICH., May 4—L. K. Cooper, who was in charge of sales for the Walter Githens Co., Maxwell distributor in Chicago, has been appointed manager of national retail sales of the Maxwell Motor Co., with headquarters at the offices in Detroit. Mr. Cooper has been identified with the Maxwell interests for years.

Mutual Liability Jitney Insurance Company Is Formed in Milwaukee

Will take All Automobile Risks—Aims to Furnish Insurance at Cost—Jitney Operators Organize and Affiliate—Other News in the Jitney Field

MILWAUKEE, WIS., May 3—The organization of a mutual liability insurance company for jitney bus owners and the introduction of a broad ordinance regulating jitney bus traffic in the common council are the latest developments in the jitney bus industry at Milwaukee.

The name of the new insurance company is the Automobile Mutual Limited Liability Co. The articles of incorporation have been filed and approved by the commissioner of insurance. Officers were elected May 1 as follows: President, Albert L. Becker; vice-president, Robert Kiefer; secretary, George L. Kohn; treasurer, George F. Harris; directors are R. C. Anderson and C. V. Kersey. Offices have been established at 617 Caswell block, Milwaukee. The new company has already offered a prize of $25 to the person offering the best suggestion for an emblem encouraging the safety first idea for drivers, to be placed on the windshield. While the mutual is formed principally to cater to jitney buses, it will take in all automobile risks. Its principal aim is to provide adequate insurance at cost to those who are practically barred from participation in liability insurance because of prohibitive rates of existing companies. Accidents have been increasing at a rapid rate and the need of protection was deemed urgent.

Jitney bus operators have been formed into a union which has affiliated with the International Brotherhood of Teamsters, Chauffeurs, Stablemen and Helpers' Union. The membership is 130. A charter has been applied for and application made for membership in the Federated Trades Council of Milwaukee.

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Everything But Fare Is Regulated in Providence

PROVIDENCE, R. I., April 28—The burden of handling the jitneys is to be imposed upon the police commission, according to the regulations adopted by the ordinance committee of this city. The City Council will pass on them Monday next. The regulations will undoubtedly be adopted as recommended. The license fee is to be $5 per passenger seat and $3 a seat for cars operating between two municipalities. The bond is to be $500 a passenger seat and the license fee for driver $1. The police commissioners are to route the machines. Routes may be changed upon application and filing 50 cents. Drivers must be 21 years of age and applicants must pass a road examination for fitness and for knowledge of traffic laws. Drivers must not smoke, use liquor, solicit trade or use any mechanical device for attracting patronage. Cars are to be limited to seating capacity, children under 7 years of age excluded, but no person with a child can occupy the front seat. Standing on running board, doors, etc., is forbidden. No jitney can stop to take on or discharge passengers within 40 feet of the white pole used by the trolley company, and none shall stop within 50 feet of any corner or intersecting street used by trolley cars. Cars must not stand in the streets or squares and three principal streets are to be barred to jitneys until after July 1. Every jitney must carry in front a sign with large letters designating route and fare to be charged. Fare is not regulated.

Warren, R. I., the first town to enact regulations for jitneys under the act passed last week by the General Assembly, has similar rules except the fee is $2 a passenger seat and brakes must be in good condition.

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Trolley President Petitions to Substitute Jitneys for Cars

BELVIDERE, ILL., May 1—Bion J. Arnold of Chicago, president of the Elgin, and Belvidere Electric Railway company, is willing to give the jitneys a chance in Belvidere. His street railway system is said to be a white elephant on his hands and he has filed with the state board of public utilities a petition seeking permanent relief from operating the Belvidere line. He offers to substitute jitney buses, claiming that he can save money by tying up the trolley cars and operating only the buses. Action was deferred by the council until the utilities commission could act upon the earlier petition.

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Jitney Owners Must Have Chauffeurs' License in New York

ALBANY, N. Y., May 2—Owners of automobiles who convert them into jitney buses and drive them for hire must obtain chauffeurs' licenses, according to an opinion handed down by Attorney General E. E. Woodbury today. The opinion was based on that provision of the motor vehicle law which reads:

"The term chauffeur shall mean any person operating or driving a motor vehicle as an employee or for hire."

"The driver of the jitney bus is driving it for hire as much as the driver of any other public conveyance," the Attorney General holds. "It is therefore my opinion that such chauffeurs should be licensed."

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First Jitney Express Line

NEW LONDON, CONN., April 29—The expected development of the jitney bus invasion of this State has come in a jitney express line, the first in Connecticut, which is to be operated between New London and Old Saybrook, taking in Waterford, Niantic, East Lyme, and Old Lyme en route. For articles weighing up to 5 pounds the charge will be 5 cents, and each additional 10 pounds will call for another 5-cent charge. The limit of weight has been set at 105 pounds, packages weighing that amount to cost the sender 55 cents. Glassware, crockery and other breakable articles are charged for at double rates.

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Reprieve for Louisville Jitneys

LOUISVILLE, KY., April 30—Hearing of the motion for a temporary injunction against Mayor Buschemeyer and the members of the Board of Public Safety and the Chief of Police to enjoin them from enforcing the jitney ordinance recently passed by the General Council was postponed until next Thursday by Judge James Quarles today on motion of City Attorney Pendleton Beckley, who announced that he was not ready to enter into an argument on the merits of the ordinance. Pending the hearing of the motion for a temporary injunction the jitney owners will be permitted to operate their cars on the streets of the city without giving bond, although the City Attorney made a brief, though hard fight to require the plaintiffs to furnish a bond pending the hearing of the motion for a temporary injunction.

It is the belief of those connected with the legal controversy growing out of the passage of the ordinance that practically the entire summer will have passed before the legality of the ordinance is finally passed upon by the Court of Appeals.

The plaintiffs allege the ordinance is unconstitutional and ask the court to enjoin the city from enforcing any of its provisions or conducting any prosecutions under the ordinance pending the action, and that upon a final hearing of the case to declare the measure unconstitutional.

The plaintiffs maintain it will be impossible for them to execute bond, as no bonding company will indemnify them unless they deposit $5,000 in cash or convertible securities in that amount, which, the plaintiffs say, none of them is able to do; that if the said ordinance

is enforced the plaintiffs will be deprived of their liberty and property without due process of law, and denied the equal protection under the Bill of Rights of the Constitution of Kentucky, and that they will be compelled to discontinue operating jitneys in the city.

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Tax Jitneys $12.50 per Seat Yearly in California

SACRAMENTO, CAL., April 24—An annual tax of $12.50 per seat on all jitney buses has been fixed by the Senate. Sight-seeing motor buses and taxicabs are exempt.

One senator argued that the decreased income of the traction companies, owing to the competition of the motor buses, had cost California almost $300,000 per year in taxes upon the gross earnings of the traction corporations. It is claimed that the tax of $12.50 per seat on motor buses carrying 5-cent fare passengers, will give back less than one-third of what the state is losing. The tax, it is claimed, is but one-tenth of 1 cent per passenger.

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Pennsylvania Railway and Power Company Can Operate Jitneys

HARRISBURG, PA., April 29—The House on April 27 passed a bill giving street passenger railways and motor power companies the right to own, lease and operate jitney lines in connection with their railway systems. Following the passage of the bill a measure regulating the operation of jitney buses was stricken from the ledger.

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$10 Per Seat in Edmonton

EDMONTON, ALTA., April 30—The city of Edmonton has passed a by-law applying to owners and users of jitney buses which became effective April 26. It reads as follows: By-law No. 632, being a by-law to regulate the use and operation of jitney cars in the city of Edmonton, and among other things provides that all such vehicles and their drivers shall be licensed as follows:

1. For every car coming within the purview of the by-law an annual fee of $10 for every seat (excluding the driver's seat), according to the seating capacity of the car as set forth in the application and in the license, the seating capacity being determined by the seating capacity for which the car was made or sold, and in other cases determined by a measurement of 18 inches for each passenger, a separate license being required for each car.

2. For every driver other than the licensed owner an annual fee of $5. In case any person applying for a jitney license under the provisions of this by-law has obtained a license as a common carrier of passengers, or for a vehicle for hire during the current year under the provisions of by-law No. 532, the sum paid for such license shall be credited to the sum payable by the applicant under the provisions of this by-law, and all licenses issued under this by-law shall expire on December 31 next succeeding the date of issue of the same and no deduction shall be made by reason of the license being issued after the first of January in this or any other year. Fares, routes and license plates must be prominently displayed.

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Jitney Men on Strike Against Ashtabula Ordinance

ASHTABULA, O., April 30—All jitney bus owners of this city, numbering about twenty, suspended operations April 29, pending investigation into the constitutionality of the stringent jitney bus ordinance passed by the City Council earlier in the week. Bus owners at Ashtabula have organized to make a fight, but apparently none cares to take the initiative by starting a test case. In the meantime petitions asking the council to reconsider its action will continue to be circulated and attorneys will be consulted with a view to taking action provided the council fails to repeal the bill at its meeting next week.

The objectionable ordinance, which was indorsed and recommended by a special committee of the Chamber of Commerce, requires every driver of a jitney to buy a license and give bond.

The license fee is placed at $100 while the cars will be bonded for $5,000 if of a capacity of nine passengers or less and $8,000 if having a larger capacity.

The ordinance also provides that no person under 21 years may operate a car, that all cars must run from 5 a. m. to 11 p. m.; that cars may carry only one more passenger than the capacity rating allowed by the manufacturer, that violators of the ordinance may be fined not to exceed $50 and that drivers violating the ordinance shall have their licenses revoked.

The ordinance comes as the result of numerous jitney accidents and the strenuous campaign of the street car company which declares the jitneys have deprived it of about $2,000 a month revenue. About 20 jitneys have been operating and of course have been doing a rushing business, owing to the vastly superior service rendered over the crowded car lines.

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10-Cent Limit for Jitney Fares, Rules St. Louis Court

ST. LOUIS, MO., April 28—Police Judge Hogan ruled today that a jitney driver should not be permitted to collect more than 10 cents for a single fare, even late at night, unless he displays a placard announcing a higher rate.

The case in which this decision was rendered was that of a service car driver who caused the arrest of two men after they refused to pay 75 cents each for a ride of several miles late at night. The men, who were charged with peace disturbance, were discharged by Judge Hogan.

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McLaughlin-Buick Builds Jitneys

OSHAWA, ONT., April 30—The McLaughlin-Buick Co., Ltd., this city, has at the present time under design the construction of a jitney car that will be comfortable, irrespective of the roads or weather conditions. These special jitney cars are of a heavier build than the ordinary touring cars now in use; they are slower and will seat sixteen persons. Some of these are already appearing in some Canadian cities.

Rust Protection By Mixing Chrome Salt with Oil or Paint

(*Continued from page* 812)

Some of these salts, and especially those containing chromium, are very active protectors against rust, and the same is the case with lime water and alkaline lyes of carbonate of potash and soda containing more than 1 per cent. of these salts. Sulphates, on the other hand, are very active rust promoters.

The best rust protection is on these principles effected by providing a mixture of the favorable salts with other protecting materials in such manner that the salts cannot be washed away. But where the question is of unpainted iron not exposed to shock or friction the simplest method is to prepare emulsions of concentrated solutions of a chromium salt with animal or vegetable oils or fats and to use such an emulsion for a coating. Similar emulsions with milk of lime are also effective but difficult to proportion so as to avoid the formation of soap. Experiments with the admixture of the salts with siccative oils and varnishes have not yet led to definite results as to the preferable materials.

Factory Miscellany

CROW Gains Require Addition — To enable the Crow Motor Car Co., Elkhart, Ind., to care for its rapidly growing business, a substantial addition with 6,000 square feet of floor space is being pushed rapidly to completion. A second story is being built over that part of the factory occupied by the body department. The sheet-metal and blacksmith departments will be moved to the second floor, and first floor of the main building will be devoted to assembling motor-car chasses. Orders have been coming in so rapidly from all parts of the country that it has been necessary to work nights.

Drop Forge Plant Operating—The James McKay Co.'s new forging plant at McKee's Rocks, Pa., is now in operation on crank and cam shafts, connecting rods and other miscellaneous forgings.

Lozier Replenishes Entire Stock—The entire stock of parts for all Lozier models ever made has been entirely replenished at an expense of about $100,000. A 1-day service for parts has been established.

Locomobile Makes Extension — The Locomobile Co. of America, Bridgeport, Conn., in addition to an extension at its Seaside Park plant has rented the new factory recently built by the Bridgeport Engineering Co.

New Tire Plant Starts May 15—The New Castle Tire and Rubber Co.'s plant in New Castle, Pa., will start operations on May 15. Rubber tires will be manufactured exclusively for a time until the plant is working well.

Studebaker Installing Steel Stamping Machine—The Studebaker Corp., Detroit, Mich., is installing a steel stamping machine in its stamping and enameling plant. It represents an investment of $20,000 and weighs 200,000 pounds. It requires 60 horsepower to operate.

Youngstown Tube Betterments—Contracts amounting to $3,000,000 for the construction of 200 by-product coke ovens at Struthers, near here, were awarded to-day by the Youngstown Sheet & Tube Co., Youngstown, O. The company plans extensions to cost $5,000,000.

New Company Buys Factory — The Wentworth-Brown Co., a newly organized concern that is going to turn out trucks designed by Mr. Brown, has just bought the J. N. Leitch factory at Amesbury, Mass.

Seattle Ford Assembles 4,241 Cars—The Seattle assembly plant of the Ford Motor Co. opened March 2, 1914, and to April 27, 1915, has assembled 4,241 cars. In excess of $300,000 was paid out in wages to the employees during the past year.

Remy Adds Another Unit—The twenty-second unit has recently been erected at the Remy Electric Co.'s mammoth plant at Anderson, Ind., to take care of the steady increase in their business. In keeping with the policy of this company to preserve intact all jigs, dies and fixtures used in the manufacture of their products, a portion of the new building will be occupied by additional safety deposit vaults for these tools. The remainder of the building will be devoted to additions to the punch press and automatic screw machine departments.

Students Visit Wisconsin Plant—About 100 engineering students from the Ohio State University, Columbus, spend 2 days in Milwaukee last week to gain practical knowledge of engineering. Among the plants especially selected for the inspection was that of the Wisconsin Motor Mfg. Co., producing the Wisconsin motor. The students were particularly impressed with operations on a number of sixteen-valve engines of the special racing type which the company is completing for several concerns, notably the Stutz company. From Milwaukee the party traveled to Detroit.

Manufacturing Centers Want Skilled Men—Cleveland, Toledo and other automobile manufacturing centers are calling on Detroit for skilled mechanics, according to Ralph Hoagland, who deals in employees for the plants. The Detroit demand is greater than the supply and Detroit is advertising for men in at least 12 different cities and without success. Unskilled labor is still to be had for the asking, but there is promise of a shortage in this field also, and that before very long. Good wages are now being offered for skilled labor, much higher than was paid at the time the market was glutted.

The Automobile Calendar

May 5-6	Detroit, Mich., Motor Truck Convention of the N. A. C. C., Hotel Statler.
May 8	Salem, Ore., Track Races; Northwest Automobile Assn.
May 15-16	Vancouver, Wash., Track Races; Northwest Automobile Assn.
May 15-16	Columbus, O., Track Race, Columbus Automobile Club.
May 17	Spokane, Wash., Show, Davenport Hotel.
May 17-18	Boston, Mass., A. A. A. Annual Meeting.
May 18-19	Boston, Mass., annual meeting of the American Automobile Assn.
May 27	Chicago, Ill., Sociability Run of Chicago Motor Club to South Bend, Ind. H. H. Robinson.
May 29	Indianapolis, Ind., 500-Mile Race, Indianapolis Motor Speedway.
May 29	Philadelphia, Pa., Stone Harbor Memorial Day Run from Philadelphia.
May 29-30	Seattle, Wash., Track Races; Northwest Automobile Assn.
June 3	New York City, 11th Annual Automobile Outing for Orphans; Orphans' Auto. Day Assn. of N. Y.
June 7-11	San Francisco, Cal., National Electric Light Assn.
June 9	Galesburg, Ill., 100-Mile Race, Galesburg District Fair Assn.
June 12	Brighton Beach, Track Race; E. A. Moross.
June 14-17	Detroit, Mich., Summer Meeting of the Society of Automobile Engineers and Start of Cruise to Georgian Bay.
June 19	Chicago, Ill., 500-Mile Race, Chicago Speedway.
July 3	Sioux City, Ia., 300-Mile Race, Sioux City Speedway Assn.
July 4	Visalia, Cal., Road Race; Tulare County Automobile Assn.
July 4-5	Tacoma, Wash., Road Race, Tacoma Speedway Assn.
July 5	Omaha, Neb., Speedway Races, Omaha Motor Speedway.
Aug	Milwaukee, Wis., Independent Petroleum Marketers' Assn. of the U. S.; 1915 Convention in Milwaukee.
Aug. 2-3	San Francisco, Cal., Tri-State Good Roads Assn., Third Annual Convention.
Aug. 20-21	Elgin, Ill., Road Race.
Sept.	Indianapolis, Ind., Fall Show, Indiana State Fair.
Sept.	Peoria, Ill., Second Northwestern Road Congress.
Sept. 6	Providence, R. I., Speedway Race; F. E. Perkins.
Sept. 6	Detroit, Mich., Speedway Race; Detroit Speedway Club.
Sept. 13	Oakland, Cal., Pan American Road Congress.
Sept. 17-18	Peoria, Ill., Illinois Garage Owners' Assn. Convention.
Sept. 20-25	San Francisco, Cal., International Engineering Congress.
Oct. 1-2	Trenton, N. J., Track Races; Inter-State Fair.
Oct. 6-16	New York City, Ninth Electrical Exposition and Motor Show at Grand Central Palace.
Dec. 31	New York City, Show; Grand Central Palace.
Jan. 22, 1916	Chicago, Ill., Show; Coliseum.

The Week in the Industry

DURRELL Manager Now—W. O. Durrell, formerly with the Diamond Tire Co., at Boston, Mass., has accepted the position of manager of the Pennsylvania Tire Co.'s branch in that city to succeed George Lawrie, who has gone into business for himself.

McKay Back in Tacoma—Will O. McKay, formerly manager of the Locomobile agency in Seattle, has returned to Tacoma, joining the sales staff of J. W. Leavitt & Co., Overland distributor in that city.

Gowdy Goes with Buick—C. E. Gowdy, for a long time manager of the service department of the Cadillac agency at Springfield, Mass., has resigned to accept a similar position with the Springfield Buick Co.

Hennem Columbiana Tire Mgr.—The Columbiana Tire and Rubber Co., Columbiana, O., has appointed as its general manager W. G. Hennem, formerly sales manager of the Mansfield (O.) Tire and Rubber Co.

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Garage

Roskam-Scott Moves—The Roskam-Scott Co. has removed to 1896 Broadway, at 63d street, New York City. The floorspace covers an area of 11,000 square feet.

Boston Auction Co. Moves—The Boston Automobile Auction Co., which has been located at 1112 Commonwealth avenue, Boston, Mass., has moved in town to 148 Berkeley street.

Silver Opens New Branch—The C. T. Silver Motor Co., New York City, has opened a branch in the Bronx for the distribution of Overland and Peerless cars at 520-522 Willis avenue, which is at 149th street and Third avenue. A. D. Frost is the manager.

New Garages for Milwaukee—Three large garages are about to be erected in Milwaukee, Wis., to fill the needs of three widely separated sections of the city. A permit has been granted to build a large garage at West Water and Sycamore streets, in the heart of the city. R. Grossenbach will build a 22 by 144-foot garage at Fifth and Center streets, on the north side. William Scheutt has plans for a new garage at Prospect and North avenues, to be 45 by 143 feet in size. In addition, scores of smaller garages are under construction or contemplated in various sections of the city.

Motor Men in New Roles

Hoffman Sales Mgr.—P. G. Hoffman, for 2 years retail salesman of Los Angeles Studebaker branch, has been appointed sales manager of the branch there.

Lucas McNaull Tire Mgr.—A. Lucas has been appointed manager of the tire depot and service station opened by the McNaull Tire Co., Akron, O., at 16 Alexandrine street East.

Horan Lozier's N. Y. Mgr.—J. H. Horan has been appointed manager of the New York City branch of the Lozier Motor Co. The branch is located at 11th avenue and 47th street.

McClure Sales Mgr.—M. W. McClure has been appointed southwestern sales manager for the International Harvester Co.'s trucks and will have his headquarters in Dallas, Tex. Mr. McClure was only recently with the Marion Motor Car Co.

Robinson Quits the Regal—C. R. Robinson, who formed the C. R. Robinson Co., in Boston, Mass., some time ago to handle the Regal line in that city, has retired from the company owing to ill health and H. N. Klegge is carrying on the business.

Gray Sells Velie Interest—W. A. Gray, for 2 years manager of the Velie Motor Co. of Missouri, St. Louis, has sold his interest in the company and on June 1 will leave its employ. Mr. Gray has not yet definitely decided upon his future connections.

Noble Maxwell Branch Mgr.—Edward Noble, who has been associated with the Hodgins Fosdick Motor Co., Spokane, Wash., has taken the position as branch manager for this company at Walla Walla, Wash., and will act as distributor of Maxwell cars in that section.

Livingston Promoted—Joseph Livingston, formerly connected with the Indianapolis sales force of the Studebaker Corp., has been promoted to the position of assistant sales manager of the Omaha, Neb., branch, to take the place of J. C. Gerspacher, who recently severed his connection with the company.

McLaren Chalmers Rep.—J. C. McLaren, long in the Chalmers service at various points, has been appointed Tacoma representative and has opened salesrooms and service station at 710-12 Commerce street. Mr. McLaren was recently Chalmers representative for Northern Canada.

Sharp Appointed Mgr.—Al Sharp, for years associated with the Pierce-Arrow Motor Sales Co., in Seattle, Wash., has been appointed general manager of Rothweiler & Co., distributor of Cole cars in the Puget Sound country and subagents for the Ford in Seattle.

Herrick Resigns from Apperson—Harvey Herrick, former American road race champion, has severed his connection with the Los Angeles Apperson branch and joined the Earl C. Anthony organization in the capacity of sales manager, handling the Grant line exclusively, with headquarters in San Francisco.

Lininger Heads New Detroit Co.—The National passenger cars and the Bessemer trucks are now being handled in Detroit by the Metropolitan Motor Co., which has secured temporary quarters on Palmer street near Woodward avenue. William Lininger, until recently sales manager of the Vulcan Mfg. Co., Painesville, O., and a former distributor here, is at the head of the new company.

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Dealer

Detroit Chandler Station Opened—A service station for Chandler owners has been opened in Detroit, Mich., by the Gordon Auto Sales Co., 1000 Woodward avenue. Edward Monasmith, from the Chandler factory in Cleveland, is in charge.

Bosch Makes N. Y. Lease—The Bosch Magneto Co., New York, has leased the seventh floor in the building on the corner of Fifty-seventh street and Broadway, New York City, in order to permit of necessary expansion. The new quarters will house the advertising department and also the installation department for electric lighting and starting systems.

Hupp to Open Wholesale Branch—The Hupp Motor Car Co. has planned to open its own wholesale branch in Boston, Mass., after the manner of the Studebaker and Buick companies, and it has already opened offices there with R. C. Hutchins and Fred Nichols in charge temporarily. The wholesale business had formerly been handled by the Wentworth-Fosdick Co., and this company will continue as the retail agents in Boston, the other dealers throughout New England being required to do their business direct with the wholesale branch instead of the Wentworth-Fosdick Co.

Recent Incorporations in the Automobile Field

Canada

MONTREAL—Mystery manufacturer. Tire Co. of Canada; $400,000; H. Farmer, E. Laumiere, E. Farmer.

Colorado

DENVER—Orton Sleeping Auto Co.; $50,000; to manufacture sleeping berths for touring automobiles. A. Orton, C. M. Montague, G. Smith.

District of Columbia

WASHINGTON—Federal Motor Mfg. Co.; $100,000; to manufacture automobiles. R. B. Owen, W. F. A. Buehner, Babette Buehner.

Delaware

DOVER—Havana Autocab Co.; $1,000,000; bus service on Island of Cuba. H. E. Latter, N. P. Coffin, C. M. Enger, of Elkton, Md.

Illinois

AURORA—Auto Supply and Accessories Co.; $5,000; accessories manufacture. E. H. Robinson, J. A. Kramer, F. B. Shearer.

CHICAGO—Commonwealth Motor Co.; $100,000; manufacturer. C. E. Heckler, C. W. Lambern, Guy Guerinsey.

CHICAGO—International Motor Contest Assn.; $2,500. A. E. Pearson, I. K. Straus, Isidore Goodman.

CHICAGO—Spring Governor Co.; $100,000; to manufacture spring governors and other devices for automobiles. J. A. Macknight, J. J. Cullen, J. F. Mooney, C. J. Dahlstrom, Homer Milligan.

Indiana

BRAZIL—Service Garage Co.; $2,000. M. C. Cooprider, C. H. Zellars, A. M. Shattuck.

CRAWFORDSVILLE—R. & R. Mfg. Co.; $100,000; manufacturing accessories. A. L. Ringo, A. T. Grady, E. H. Tillson.

ELKHART—Eugene Atkins Co.; $10,000; accessories manufacture. W. A. Bump, W. H. Ellwood.

INDIANAPOLIS—American Standard Motor Co.; $100,000; automobile and truck manufacturing. H. B. James, P. and L. A. Gardner.

INDIANAPOLIS—A. and M. Transit Co.; $10,000; garage. N. A. Aufderheide, W. H. Montgomery, F. W. Rossmann.

INDIANAPOLIS—Double Tread Tire Co.; $2,500; tire manufacturer and dealer. W. C. Lusk, C. E. Krampert, K. A. Killilea.

INDIANAPOLIS—General Motor Service Co.; $10,000; dealer. C. L. Ballenger, P. Englehart, S. M. Fitch.

INDIANAPOLIS—States Motor Car Co.; $30,000; automobile and parts manufacture. R. C. Cope, W. B. Smith, Walter Myers.

LAWRENCEBURG — Dearborn Motor Co.; $2,000; dealer. J. W. Oberting, W. Meyer, E. A. Bauer.

NEW ALBANY—Lapping Auto Bus Co.; $500; omnibus and transfer business. G. B. and C. B. Lapping and Elmer Miller.

VINCENNES—Motor Safety Device Co.; $25,000; to manufacture automobile safety devices. Elmer Schatz, Bert Whitehouse, W. F. Pelzer.

Kentucky

LOUISVILLE—Big Jitney Co.; $500. Samuel Olson, A. C. Thompson, F. W. Cecil, E. P. Olson.

LOUISVILLE—Firestone Jitney Co.; $500. C. F. Aufenkamp, E. D. Aufenkamp.

LOUISVILLE—M. & M. Jitney Co.; $900. Morris Monsky, Max and Sam Munsey.

LOUISVILLE—Nickel Automobile Co.; $10,000; jitney bus line. Wm. A. Baker, S. S. Jones, W. P. McDonogh.

Louisiana

ALEXANDRIA—Alexandria Jitneymobile Co.; $25,000; jitney bus line. P. A. Gilham, W. R. O'Neal, Gus Gehr and others.

Massachusetts

WATERTOWN—Hood Tire Co.; $20,000; to manufacture tires. C. W. Dailey, Jr., H. E. Rose, R. Muir.

Michigan

DETROIT—Associated Lozier Purchasers of Wayne County; $20,000. Theodore Friedman, Murray Rothschild, Harry Frank.

DETROIT—Kosmath Co.; $50,000; to manufacture automobile trucks and delivery cars. E. T. Birdsall, G. L. Sintz, F. C. Sibley.

DETROIT—Standard Motor Parts Co.; $300,000; to manufacture automobile parts. E. J. Dayton, W. S. Grant, Oscar Gumbinsky.

DETROIT—Wolverine Garage Co.; $1,200. A. T. Hamlin, J. R. Gilbert, C. C. Harnbridge.

PONTIAC—Pontiac Chassis Co.; $100,000; to manufacture automobiles. R. A. Palmer, E. P. Waldron, M. D. Hubbard.

Missouri

ST. LOUIS—Carter Motors Co.; $3,000; to manufacture engines and automobile parts. C. O. Baxter, A. H. Little, H. H. C. Weed.

ST. LOUIS—Detroit Electric Car Co. of Missouri; $2,000. M. B. Strauss, C. D. Long, C. M. Rice.

ST. LOUIS—D. C. Gilliland Mfg. & Auto Supply Co.; $8,000; to manufacture automobile supplies. D. C. Gilliland, E. P. Orner, H. F. Spoenemann.

ST. LOUIS—St. Louis Auto & Transportation Co.; $2,000. C. F. Betz, Jacob Hagelstein, Richard Mederacke.

WEBB CITY—Auto Transportation Co.; $30,000; automobile line. E. J. Pratt, D. C. Morris, A. H. Rogers.

New York City

NEW YORK CITY—O. C. Arlitz & Co.; $25,000; dealer. O. C. Arlitz, David Morris, G. L. Stamper.

NEW YORK CITY—Bradley Packard Auto Renting Co.; $500. J. H. Bradley, J. A. Clynes, E. J. Dooling.

NEW YORK CITY—B. L. B. Mfg. Co.; $12,000; accessory manufacturing. L. E. Bregand, G. G. Bouthinen, G. N. Nelson.

NEW YORK CITY—Briarly-Tucker Auto Service Co.; $2,000; garage. J. W. Briarly, H. W. Briarly, H. J. Tucker.

NEW YORK CITY—Clark & Kendrick; $10,000; repairing. W. C. Clark, A. R. Kendrick, L. J. Rose.

NEW YORK CITY—Clayton Auto Painting & Trimming Co.; $20,000. Wm. Berkowitz, Morris Schwartz, Abr. Schwartz.

NEW YORK CITY—Coalition Co.; $8,000; manufacturing motors, vehicles. Abram Wyse, H. C. Gibson, Emil Frankel, Woolworth Bldg.

NEW YORK CITY—Columbus Circle Gasoline & Oil Co.; $5,000. Maurice Deutsch, 50 Church street; E. I. Ahrweiler, E. M. Grossman.

NEW YORK CITY—Cosmopolitan Export Co.; $30,000; automobile supplies. Concetta De Prade, Giovanni De Prade, Almo Landi, 1777 Broadway.

NEW YORK CITY—Dan-Mar Corp.; $25,000; devices for making tires puncture proof. Celia Selemen, David Greenbaum, Moses Lewis, 383 St. John's Place, Brooklyn.

NEW YORK CITY—Electric Automobile Delivery Corp.; $10,000; garage and dealer. Geo. Tiernan, F. H. Parcells, J. B. Purcell, all of 50 Wall street.

NEW YORK CITY—Greeley Square Garage Co.; $2,000. E. B. McNally, Jeanette Teplitz, J. T. Ryan.

NEW YORK CITY—Guttag & Stengel; $1,000; mail order business in automobile supplies. C. M. Rosenthal, J. M. Baum, Max Horowitz, all of 35 Nassau street.

NEW YORK CITY—M. George Tigar Bearings Co.; $10,000; manufacturing bearings for automobiles and machinery. M. G. Tigar, A. R. Tigar, Sol. Cohen, 5217 New Utrecht avenue.

NEW YORK CITY—Hub Garage Co.; $2,000. H. Abr, A. Ahr, J. T. Booth.

NEW YORK CITY—Kim Sales Co.; 02,500; to deal in springs, shock absorbers. Daniel Houston, S. O'Brein, G. C. Norton.

NEW YORK CITY—Leuner & Hannon; $500; expert haulmen of New York. Joseph Leuner, James J. Hannon. Both come from Bronx, N. Y.

NEW YORK CITY—Lexington Auto Supply Co.; $15,000; dealer. M. A. Noble, R. H. Waddell, A. M. Nascher.

NEW YORK CITY—Liesmann's Garage; $1,000. H. Liesmann, Edw. Eberhart, F. A. Eberhart.

NEW YORK CITY—Lucerne Garage Corp.; $3,000. C. H. Minder, P. W. Hanrahan, R. J. Algie.

NEW YORK CITY—Malcolm Motor Car Co.; $35,000; dealer. G. J. Rubin, E. J. Otis, Max Greenberger.

NEW YORK CITY—McFarlan Six Sales Co.; $10,000; dealer. S. J. Fleet, F. L. Shelp, H. E. Persons.

NEW YORK CITY—Motor Vehicle Sales Corp.; $1,000; dealer. H. T. Edwards, Henry Caplan, T. G. Durkhan, all of 68 William street.

NEW YORK CITY—Motor Utilities Co.; $25,000; automobiles, motors, engineers, machinists. R E. McLear, R. C. Lipman, L. E. Johnson, 115 Broadway.

NEW YORK CITY—Multiple Worm Axle Corp.; $100,000; worm-gear driving mechanisms for motors and vehicles. A. W. Chase, A. L. Kull, J. W. Rowland, 32 Broadway.

NEW YORK CITY—New York Electric Garage Corp.; $50,000; garage for electrics. I. W. Bonner, R. R. Livingston, J. W. Crandall, all of 165 Broadway.

NEW YORK CITY—Safety Auto Equipment Corp.; $10,000. S. M. Richardson, H. A. Vincent, Moses Ely, 2 Rector street.

NEW YORK CITY—Security Vehicle Lock & Brake Co.; $50,000; to manufacture automobile locks. Selman Liss, Leopold Tropp, Bert Rivkin, 555 E. 169th street.

NEW YORK CITY—Safety Brake Co.; $2,000; to manufacture brakes for automobiles. August Marhenke, Henry Klinger, Henry Kragel.

NEW YORK CITY—Seubert Bearing Co.; $1,000,000; to manufacture ball bearings, etc. L. H. Seubert, Hotel Marseilles, New York City; C. A. Whitney, W. E. Lowther.

NEW YORK CITY—Simpson Motor Corp.; $3,000; dealer. Edw. Cynamon, G. H. Levine, Abr. Levine.

NEW YORK CITY—Smith, Norem & Co.; $20,000; manufacturing automobiles. R. U. Kraus, W. M. Smith, H. P. Norem, all of 1790 Broadway.

NEW YORK CITY—Sheepshead Bay Speedway Corp.; $2,500,000; to maintain and operate automobile speedway. L. P. Reeder, G. H. Brevillier, A. M. Fowler, both of 32 Liberty street.

NEW YORK CITY—Theobald Auto Exchange; $2,000; dealer. J. L. Dunham, W. P. Buchler, J. B. Kalmuk.

NEW YORK CITY—Witherbee Storage Battery Co.; $10,000; batteries, appliances for automobiles and electrical goods. E. E. Jacobsen, C. J. Steirerman, M. J. Hanlon, 52 Brook St., Tompkinsville, N. Y.

NEW YORK CITY—Yankee Heavy Oil Motor Co.; $50,000; to operate refineries, manufacture metal products and machinery. G. Kelser, E. J. Dooling, J. A. Clynes.

NEW YORK CITY—Gillett-Johnson Co.; $5,000; dealer. F. D. Gillett, C. L. G. Johnson, A. J. Johnson.

NEW YORK CITY—West 67th Street Garage; $5,000; Lillian Carlin, S. L. Cohen, Rose O'Rourke, all of 31 Nassau street.

NEW YORK CITY—63d St. Garage; $5,000. George Bauchfass, W. Layman, 1904 Broadway; T. F. MacMahon.

NEW YORK CITY—Hammond-Williams Convertible Top Co.; $5,000; manufacturer tops, waterproof covers, slip covers, etc. J. C. Hammond, Aaron Rachofsky, 1328 Broadway; C. D. Williams.

NEW YORK CITY—Heliclox Tire Co., $100,000; manufacturer. L. E. Maginn, S. W. Rogers, T. H. Soule, 2 Rector street.

NEW YORK CITY—Heina Tire Co.; $15,000; tire manufacturer. W. M. Heina, E. V. Derks, E. A. Kammler, 618 Newark avenue, Jersey City, N. J.

NEW YORK CITY—Hotel Rental Service; $2,500; renting. W. Trock, M. Trock, 315 W. 79th street; C. A. Hitchcock.

NEW YORK CITY—I. T. Motor Renting Co.; $2,000. H. L. Toomey, C. C. Ingraham, P. B. Ingraham, 3915 Broadway.

NEW YORK CITY—Ideal Auto Supply Co.; $10,000; dealer. Frank Weinstein, Samuel Kaplan, H. G. Kosch, 126 W. 46th street.

NEW YORK CITY—Joseph J. Kittel; $10,000; dealer. Miriam Kittel, J. J. Kittel, R. H. Kittel, 496 Riverside drive.

NEW YORK CITY—Lobell-Aborn Auto Co.; $6,000; dealer. M. B. Lobell, 940 Tiffany street, Bronx; J. Aborn, M. Jawitz.

NEW YORK CITY—J. T. MacWilliam; $1,000; dealer in automobiles and accessories. M. R. MacWilliam, J. T. MacWilliam, S. G. Sterne, all of 510 W. 140th street.

NEW YORK CITY—Mecca Rubber Co.; $1,000; tire manufacturer. E. J. Kern, G. B. Marshall, K. W. Tompkins, 222 W. 141st street.

NEW YORK CITY—Monarch Auto Supply Co.; $10,000; dealer. Louis Levene, 6 W. 107th street; Max Richman, Leopold Philip.

NEW YORK CITY—National Tireseal Co.; $100,000; manufacture secret compound for sealing tires. David Lock, 157 W. 54th street; G. W. Lebolt, S. Stern.

NEW YORK CITY—New Denver Ford Starter Corp.; $20,000; manufacturing starters, parts and accessories. J. Robinson-Duff, 35 Broad street; M. L. Effinger, J. T. McGovern.

NEW YORK CITY—Primer & Mixture Regulator Co.; $5,000; carbureter devices for automobiles. E. A. McCoy, A. J. Weiss, Frederick Richardson, 1590 Amsterdam avenue.

NEW YORK CITY—Regent Garage; $1,000; dealer. K. Donnelly, J. G. Donnelly, 40 W. 127th street; W. J. Doyle.

NEW YORK CITY—E. Schoonmaker Co.; $25,000; tire manufacturer. Ellis Schoonmaker, L. N. Mansuy, H. I. Huber.

NEW YORK CITY—Seventy-fourth Street Co.; $500. W. Korn, 875 Park avenue; J. L. B. Mayer, B. Mayer.

NEW YORK CITY—Shaw Pearson Motor Corp.; $2,000; dealer. O. F. Shaw, Jr., H. E. Meyn, 363 Lenox road, Brooklyn; F. A. Hallock.

NEW YORK CITY—Transport Tractor Co.; $100,000; motor tractors. A. W. Moffat, 11 Cedar Court, Flushing, N. Y.; F. B. Stimson, F. J. Stimson.

NEW YORK CITY—Tremont Tire & Supply Co.; $2,000; dealer. N. J. Finney, E. A. Finney, M. B. Coleman, all of 543 E. 184th street.

NEW YORK CITY—United Auto Truck Co.; $5,000; dealer. D. Diamond, P. Diamond, 329 E. 20th street; Louis Weitzman.

NEW YORK CITY—Universal Safety Brake Co.; $25,000; automobile brakes. Samuel Wiesenberg, 341 Crimmins avenue, Bronx; L. M. Bernfeld, Rose Bernfeld.

NEW YORK CITY—Yankee Heavy Oil Motor Co.; $50,000. E. J. Dooling, Brooklyn; J. A. Clynes.

New York

ALBANY—Yellow Taxi Service; $500; automobile livery business. H. W. Maclellan, E. V. Stratton, C. D. Hakes.

BROOKLYN—B. H. S. Co.; $500; dealer. M. M. Black, G. Heatter, P. H. Siegel.

BROOKLYN—East New York Garage; $1,000. B. T. Foreman, C. A. Cornelius, H. K. Cornelius.

BROOKLYN—Robert A. Hill's Garage; $1,000. R. A. Hill, M. E. Hill, R. E. Palmer.

BROOKLYN—Watkins Street Garage; $5,000. S. Morris, A. Bernstein, W. Domroe.

BUFFALO—A. F. Oliver Gear & Machine Co.; $20,000; manufacturer. A. F. Oliver, C. L. Wiedrich, M. S. Gibbs.

ELMIRA—Elmira Motor Sales Co.; $1,000; dealer. Harry Thompson, W. H. Messimer, H. F. Lundy.

FREEPORT—Diamond Tire Sales Co.; $10,000; dealer. T. P. C. Forbes, Alexander Forbes, Julius Bindrim, 511 Lafayette avenue, Brooklyn.

HORNELL—Transcontinental Wheel Co.; $125,000; to manufacture wheels, rotary appliances. H. Orsenige, E. J. Orsenige, F. V. Ubezzi.

INWOOD—J. M. J. Garage; $5,000. A. H. Jenkins, Lester Jacobson, Martin Morrison, Hollywood, N. Y.

MT. VERNON—Vernon Heights Garage; $3,000. E. E. Uitecht, A. A. Uitecht, W. J. Terwilliger.

NIAGARA FALLS—A. D. Allen Automobile Co.; $2,500; automobile renting. A. D. Allen, L. A. Allen, C. E. Allen, 551 Eleventh street.

NEW ROCHELLE—Westchester Auto Sales Co.; $10,000; dealer. P. J. Holdsworth, J. L. Froeborn, B. M. Holden.

PEEKSKILL—Adjustable Wheel Co.; $5,000; to manufacture wheels for automobiles and other vehicles. J. H. Murray, R. C. Weaver, J. W. Husted.

PELHAM MANOR—K. Auto Service; $500; garage. D. A. Dusenberry, E. A. Kaye, R. G. Kaye.

ROCHESTER—Kwad Motor Vehicle Co.; $2,500; dealer. W. M. Kipp, M. L. Allen, R. L. Davis.

ROCHESTER—Rochester Motoring Assn. and Service Co.; $10,000; supplies. Bert Van Tuyle, M. L. Kenning, L. H. Kenning.

Recent Incorporations in the Automobile Field

New York

ROCHESTER—White Star Jitney Line; $50,000; bus line. Wm. Cross, W. J. Dever, G. V. Kendolf.

ROME—Rome and Northern Auto-Bus Co.; $2,000; automobile bus line between Rome and Boonville. Gaylord Jones, A. S. Noonan, W. C. Perry.

SYRACUSE—Bartlett & Smith Motor Co.; $10,000; dealer. G. W. Bartlett, E. C. Bartlett, G. W. Stickney.

SYRACUSE—Syracuse Auto Bus; $15,000; bus line. C. J. Piquet, Adam Helterline, W. H. Hinckley.

TROY—Empire Motor Truck Corp.; $10,000; dealer. L. A. Robinson, A. L. Johnson, Walter Dix.

WANTAGH—Wantagh Garage; $1,000. Birdsall Jackson, Walter Ashdown, G. S. Jackson.

WHITE PLAINS—Central Transfer & Taxi-Cab Co.; $5,000. G. L. O'Brien, E. A. O'Brien, W. A. O'Brien.

Oklahoma

TULSA—Southwestern Motor Wheel Co.; $10,000; dealer. F. P. Peterson, E. W. Richey, R. E. E. Andrews.

Ohio

AKRON—Akron Auto Livery Co.; $40,000; taxicab service. C. F. Schnee, A. L. Schultz, M. C. Mitchell, C. C. McNeil, E. L. Schnee.

ATHENS—Butcher Buick Co.; $10,000; dealer. R. C. Fulton, Ura Butcher, E. A. Van Den Broeck, A. H. Boggs, J. D. Connett.

CANTON—Reo Motor Sales Co.; $10,000; dealer. John Jacob, Jr., Edgar Harris, F. X. Volzer, P. Campbell, William Jacob, Olivia Daum.

CINCINNATI—Cincinnati Motor Coach Co.; $10,000; bus lines. C. R. Kearn, Louis Bauer, A. J. Kaufhold, L. N. Bachman, Hartzell Abbott, C. W. Melzer.

CINCINNATI—Fulton-Colwell Co.; $10,000; dealer. H. F. Fulton, F. C. Colwell, R. P. Goldman, Robert Kromer, F. Watson.

CINCINNATI—Northern Garage Co.; $1,000. R. H. Doepke, W. L. Doepke, F. Morris, E. B. Ulrich, H. H. Wiggers.

CINCINNATI—Talbot Tire Armor Co.; $10,000; puncture-proof tire armors. F. R. Talbot, F. Morris, G. M. Spear, C. H. Davis, W. Schmidt, Jr.

CINCINNATI—White Mfg. Co.; $10,000; rubber articles and automobile accessories. I. J. Cooper, W. L. Busch, W. C. Latta, A. E. Apking, F. F. Cooper.

CLEVELAND—Colonial Grube Auto Service Co.; $10,000; repair shop and taxicab company. W. H. Swarts, N. B. Taylor, A. E. Goldhamer, I. M. Curtice, H. B. Brackenridge.

CLEVELAND—Theodore Kundtz Co.; $2,000,000; to manufacture automobile bodies, trucks, wheels and other articles made from wood or metal. Theodore Kundtz, Theodore Kundtz, Jr., Nick Winkel, J. J. Gedeon, Frank Friedle, B. S. Edgerly.

CLEVELAND—Marvel Automobile Supply Co.; to Marvel Accessories Mfg. Co.

CLEVELAND—Novo Motor Truck Co.; $10,000; dealer. J. J. Klein, W. H. Stein, William Gobson, M. V. Amerman, C. D. Mason.

CLEVELAND—Lake City Mfg. & Supply Co.; $10,000; automobile dealer. G. H. Hanna, J. J. Gillespie, J. E. Filbin, Fred Amsden, J. W. Sheahan.

CLEVELAND—Scripps-Booth Sales Co.; $10,000; dealer. M. G. Summers, R. C. Carter, W. H. Stevens, J. B. Stevens, C. S. Thomas.

CUYAHOGA FALLS—Falls Clutch and Machinery Co.; $1,000; clutches and automobile parts. Charles McClusky, L. H. Adams, Arthur Higgs, H. P. Day, P. V. Ross.

CUYAHOGA FALLS—Globe Rubber Co.; $20,000; tires. F. J. Creque, F. C. Francisco, T. J. Francisco, L. H. Adams.

DAYTON—J. L. B. Motor Co.; $15,000; dealer. C. W. Dale, S. C. Kusworm, Charles Troy, J. L. Baker, J. W. Baker.

ELYRIA—Elyria Tire & Rubber Co.; $250,000; manufacturer. A. G. Snow, E. P. Parshall, G. G. Gilbert, C. W. Neubrand, J. L. Lind.

LEIPSIC—Standard Auto Accessory Co.; $3,000; to manufacture accessories and parts. R. F. Thompson, C. W. Fogle, W. S. Thompson, Frances Thompson, Adelaine Werner.

LIMA—Garford Motor Truck Co.; $5,000; to manufacture and sell trucks. E. W. Stevens, J. B. Immler, P. J. Long, A. C. Fenwick, R. W. Loichot.

MEDINA—Medina County Garage Co.; $10,000. A. C. Marsh, F. F. Clark, H. E. Kimmell, C. R. Warner, T. F. Hallock.

REYNOLDSBURG—Reynoldsburg Transportation Co.; $2,000; bus line. N. H. Rickley, C. L. Graham, J. J. Enlows, A. J. Green, W. S. Scully.

SANDUSKY—Robert Motor Mfg. Co. of Sandusky; $50,000; to manufacture motors and other machinery. B. B. King, W. H. Burke, R. K. Ramsey, J. C. Fyle, A. K. Hier.

SPRINGFIELD—Ensign Motor Co.; $30,000; garage. H. C. Ensign and others.

SPRINGFIELD—L. & L. Co.; $10,000; dealer. R. H. Leason, T. Leason, J. P. Cole, E. V. Elser, T. D. Hodge.

SPRINGFIELD—Springfield Auto Deflector Co.; $2,500,000; accessories manufacture. H. O. Wheeler, G. C. and M. B. Martin, R. C. Lorentz, E. J. Twoomey.

TOLEDO—Pilliod Motor Co.; $100,000; to manufacture automobiles and trucks. C. J. Pilliod, C. J. Pilliod, Jr., G. H. Hartman, S. Farner, Jr., G. J. Defenthaler.

TOLEDO—Richter Automobile Machine Co.; $25,000; dealer. W. E. Richter, C. F. Gilchrist, H. C. Warner, C. A. Moon, G. F. Blank.

TOLEDO—Seyfang Garage Co.; $1,000. F. M. Seyfang, H. H. Blair, Fred Mundhenk, C. C. Seyfang, J. J. Blair.

TOLEDO—Toledo Motor Coach Co.; $10,000; bus line. V. E. Phelps, E. M. Phelps, W. E. Phelps, O. E. Phelps, C. S. Machner.

TOLEDO—Toledo Motor Speedway Co.; $10,000; to give racing exhibitions. P. T. Gayner, A. A. Reckberger, A. E. Pierce, J. H. O'Leary.

YOUNGSTOWN—Youngstown Transportation Co.; $12,000; to operate motor buses and taxicabs. I. M. Hartzell, Mark Perkins, R. C. Wright, J. R. Claxton, W. B. Young.

South Carolina

HARTSVILLE—McDonald Bros. Motor Co.; $5,000; dealer. Carl McDonald, L. J. McDonald.

Tennessee

ELIZABETHTON—City Garage; $5,000. J. H. Grayson, W. M. Vaught, J. P. Bowers.

MEMPHIS—Donelson Auto Supply Co.; $5,000; dealer. L. R. Donelson, Jr., A. J. Donelson, J. D. Martin.

MEMPHIS—Union Jitney Co.; bus line. Casey Todd, J. W. Spence, W. A. Schmitt.

Texas

AUSTIN—Capital City Auto Co.; $8,000; dealer. W. M. Graham, H. H. Taylor, L. S. Houston.

HOUSTON—Overland Sales Co.; $1,000; dealer. J. E. Hero, G. W. Graham, D. Riegel.

KANSAS CITY—Byerley-Hoole Tire & Repair Co.; $5,000; dealer. C. T. Byerley, J. C. Hoole, H. A. Bantillier.

Virginia

RICHMOND—Richmond Jitney Bus Co.; $10,000; bus line. E. R. Alphin, M. Libbey.

Washington

WENATCHEE—Wenatchee Tire & Auto Co.; $5,000; dealer. G. K. Seaman, Ray Sagendorf, Phillip Sagendorf.

SEATTLE—West Coast Motor Co.; $250,000; dealer J. B. Hill, R. B. Martin, J. C. Doyle.

Wisconsin

BELOIT—R. & L. Instrument Co.; $25,000; to manufacture signal devices for motor cars and trucks. J. E. Keeley, L. S. Carr, H. D. Ball, J. L. Floyd.

LA CROSSE—National Gauge & Equipment Co.; $200,000; gauges and parts. D. G. MacMillan, P. M. Gelatt, J. M. La Voque.

MILWAUKEE—Auto Mart; $20,000; dealer. I. Lazarus, E. Lazarus, G. Glicksman.

MILWAUKEE—Auto Service & Supply Co.; $10,000; dealer. R. B. Mueller, T. A. Eberhardt, Dr. J. Moeller.

MILWAUKEE—J. J. Dougherty Co.; $6,000; dealer. J. J. Dougherty, C. E. Signer, R. A. Schwartzburg.

MILWAUKEE—Milwaukee Auto Tire Exchange; $10,000; dealer. W. R. Thomson, L. E. Schroeder, W. N. Durkin.

RACINE—Racine Handy Mfg. Co.; $10,000; to manufacture automobile specialties. H. B. Mansfield, C. C. and B. C. Thronson.

RACINE—Wisconsin Machinery Co.; $10,000; to manufacture, rebuild and repair tools, engines, machinery. R. T. Ingalls, Charles Rasmussen.

SHEBOYGAN—Rummele-Kriel Co.; $10,000; garage. E. H. Rummele, E. L. Kriel, A. F. Rummele.

SPRING VALLEY—Kriesel Motor Co.; $25,000; gasoline engines. Rudey Kriesel, Phoebe Kriesel, J. E. Graelle.

Automobile Agencies Recently Established

PASSENGER CARS

Arizona

Douglas	Stanley	Reno Brothers

California

Fresno	Oldsmobile	Neideraur Motor Car Co.
Needles	Chevrolet	R. B. Wilkin
Oxnard	Kissel	J. L. Milligan
Pasadena	Chevrolet	Hoard Bros. & Nelson
Pomona	Chevrolet	E. M. Hubsch
Riverside	Chevrolet	R. G. Stewart
San Bernardino	Chevrolet	E. Reber
an Bernardino	Trumbull	E. W. Lockwood
San Diego	Chevrolet	L. J. Phelps
Santa Ana	Chevrolet	Pierce & Drake
Santa Barbara	Chevrolet	S. G. Ore
Taft	Chevrolet	C. H. Allinson

Colorado

Boulder	Stanley	C. G. Hickox
Denver	Rauch & Lang	Colorado Motor Car Co.
Denver	Milburn Electric	Auto Sales Corp.
Denver	Imp	Tremont Garage
Denver	Hollier	G. H. Estabrook
Denver	Marmon	Roberts Auto Co.
Denver	Inter-State	Wm. Thorney Auto Co.
Ft. Collins	Franklin	H. D. Parker
Limon	Dodge	R. L. Ritter

Iowa

Council Bluffs	Oldsmobile	Raapke Motor Co.

Maine

Brunswick	Oldsmobile	W. F. Senter
Portland	National	Maine Motor Car Co.

Maryland

Baltimore	Briscoe	T. B. Kinnamon

Massachusetts

Boston	Lozier	J. J. McCarthy
Boston	Premier	G. X. Bishop
Brockton	Chandler	A. L. Turner
Quincy	Reo	T. W. Hodgkinson
Springfield	Allen	F. Schmidt
Springfield	Moyer	F. Schmidt

Michigan

Alpena	Oakland	A. Hansen
Crystal Falls	Dodge	Bregger Auto Sales Co.
Grand Rapids	Apperson	Kibby & Pierce
Harrisville	Ford	C. M. Lund
Holly	Grant	Holly Garage
Jackson	Jackson	Letts Auto & Taxi Co.
Saginaw	Argo	S. H. Heginbottom & Sons
Three Rivers	Crow-Elkhart	Cook & Hagenouch

Minnesota

Northfield	Oldsmobile	C. E. Hathaway

Missouri

Hannibal	Franklin	E. C. Long

Ohio

Cincinnati	Briscoe	Citizens Motor Car Co.
Cincinnati	Enger	E. L. Jones
Cleveland	Monarch	Albaugh Motor Sales Co.
Cleveland	Saxon	Albaugh Motor Sales Co.
Cleveland	Detroiter	Albaugh Motor Sales Co.
Cleveland	Princess	Albaugh Motor Sales Co.
Cleveland	Apperson	Stark Auto Co.
Cleveland	Oakland	Adams Oakland Co.
Cleveland	Moon	Dunham Motor Car Co.
Columbus	Marmon	Marmon Motor Car Co.
Marion	Dodge	N. H. Davis
Loudonville	Buick	G. W. Carey
Massillon	Buick	W. F. Wagner
Mechanicsburg	Briscoe	E. R. Stockwell
Newark	Kissel	W. B. Nye
Minerva	Buick	C. C. Cooper
Mt. Sterling	Briscoe	B. H. Candy
Newark	Briscoe	S. E. Forsythe
Newark	Buick	Spillman Bros. Garage
Newcomerstown	Buick	F. Mulvane
New Concord	Buick	J. H. McKinney
New London	Buick	O. E. Hemenway
New Washington	Buick	J. E. Weiss
Niles	Buick	J. E. Heathman
Pickering	Briscoe	J. M. Boyle
Radnor	Briscoe	Radnor Elevator Co.
Rayland	Oldsmobile	A. B. Oliver
Richwood	Briscoe	Roberts & Perry
Richwood	King	Kagay Bros. & Shaffe
Sebring	Buick	Cooper & Sebring
Spencer Station	Buick	J. F. Kennedy
St. Marys	Franklin	Charles Wirtz
Uhrichsville	Buick	L. J. Lytle
Warren	Buick	W. H. Marsh
Wadsworth	Buick	Niswender & Pierce

Oregon

Ashland	Stanley	Staples & Son

Pennsylvania

Harrisburg	Franklin	Ensminger Motor Co.

Rhode Island

Providence	Apperson	Baird-North Co.

Tennessee

Nashville	Kissel	W. Howard Douglas

Texas

Childress	Moon	Pigott Auto Co.
Fort Worth	Oldsmobile	Oldsmobile Sales Co.
Lubbock	Oldsmobile	W. G. Sherrod
San Antonio	Chevrolet	H. L. Knight

Washington

Harrington	Ford	Charlton & McInnis
Odessa	Oakland	J. A. Murbach
Spokane	Hudson	Hawkins-Twitchell Auto Co.

Wisconsin

Dodgeville	Overland	Ellis & Vivian
Elkhorn	Regal	Opitz Bros.
Ellsworth	Studebaker	J. Gaarden
Ellsworth	Dodge	J. Gaarden
Ft. Atkinson	Allen	H. Lalk
Grand Rapids	Hupmobile	Leon Arpin
Ladysmith	Ford	Ryall's Garage
Mayville	Dodge	Pioneer Auto Co.
New Richmond	Dodge	M. C. Emerson
New Richmond	Sphinx	Quinlan Bros.
New Richmond	Paige	C. J. Mulrooney
New Richmond	Studebaker	J. P. Johnson
Oconto Falls	Reo	Bunn & Kaufmann
Rhinelander	Ford	Oneida Garage Co.